Senior 4 Applied Mathematics (40S)
Standards Test

Administration Manual for Supervising Teachers

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Manitoba
Education
and Youth

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Preface

This *Administration Manual for Supervising Teachers* is distributed to teachers and administrators, and must be read prior to administering the standards test. The rules and guidelines in this manual must be strictly observed to ensure the consistency of standards test administration.

Please use this manual in conjunction with the registration package, the *Policies and Procedures for Standards Tests* handbook and the *Information Bulletin* to gain a full understanding of the protocols and procedures associated with this test. This manual contains general information about the test, step-by-step instructions for each day of the test administration, and policies regarding absenteeism, lateness, violation of rules, etc.

If you encounter exceptional circumstances not addressed in this manual, or if you have further inquiries, contact Brenda Brokenshire, Administrative Officer, at 945-5114, or toll-free at 1 800 282-8069, extension 5114.

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General Information

Manitoba Education and Youth develops all standards tests in collaboration with teachers from across the province. This standards test is based on the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)*.

The standards test is locally marked and counts for 30% of each student's final grade in the course. Marking instructions are provided by the department immediately following test administration. School principals will receive Senior 4 Applied Mathematics (40S) Standards Test *Marking Guides* by January 23, 2003. The *Marking Guides* are to be stored in a secure location until 12:30 p.m. on January 23, 2003. Student results on the test will be released to students according to local policy on the date designated by local jurisdictions.

All students enrolled in Senior 4 Applied Mathematics (40S), except those who have been exempted, must write the Senior 4 Applied Mathematics (40S) Standards Test on January 22 and 23, 2003. However, a student may rewrite a mandatory provincial standards test at any regularly scheduled administration without being registered in the course (see *Policies and Procedures for Standards Tests*, Section 3.1).

Students are expected to write the standards test as scheduled near the end of the semester in which they take the course (i.e., January for first-semester courses, June for second-semester and full-year courses).

All schools should receive the test materials by January 13, 2003. Principals of public schools receive test materials from their division offices. Principals of independent and band-operated schools will receive test materials directly from the Assessment and Evaluation Branch.

The number of test booklets sent to each school is based on the October 15, 2002 registration information provided by the school. Please advise Brenda Brokenshire, Administrative Officer, at 945-5114, or toll-free at 1 800 282-8069, extension 5114, immediately if the number of students registered to write the test has increased since registration.

In the context of marking standards tests at the local level, Manitoba Education and Youth will:

- train representatives from local jurisdictions to act as Local Marking Co-ordinators.
- collect and scan all *Answer/Scoring Sheets* (for the Written Test) and *Recording Sheets* (for the Inquiry Task) from jurisdictions to provide them with test result summaries.
- centrally mark a random sample of locally-marked test booklets to provide feedback to jurisdictions on their local marking.
- support provincially-funded local jurisdictions by providing $10.00 for each locally-marked test administered in accordance with the test schedule noted on page 3.

Features of the test

- The test is comprised of two components: an Inquiry Task and a Written Test.
- English or French versions of the test will be available for students enrolled in Senior 4 Applied Mathematics (40S) and « Mathématiques appliquées de secondaire 4 (40S) ».
- The Inquiry Task component consists of items targeting two curriculum units of the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)*. This school year for both semesters, the two units assessed by the Inquiry Task are Personal Finance and Design and Measurement.
- The Written Test will assess the remaining six curriculum units and will not include items from the two units already assessed by the Inquiry Task.
- The Inquiry Task comprises 25% and the Written Test 75% of the total marks of the standards test.
- The Inquiry Task requires the use of technology such as computer software and/or a graphing calculator.
- The Written Test requires the use of a graphing calculator although students may use computer software depending on the tools normally used in the classroom for instruction.
- The main characteristic of the Inquiry Task is the investigative nature of the items that require some reflection on the part of the student for problem solving. The Inquiry Task will consist only of constructed-response items that may range from restricted-response, restricted-response with explanation to open-response items.
- The Written Test will consist of multiple-choice items as well as constructed-response items.
- Strict administrative procedures as detailed in this manual need to be followed by the classroom teacher to avoid any compromise to the integrity of the test.

Test schedule

The following table summarizes the schedule for the Senior 4 Applied Mathematics (40S) Standards Test:

Date	Session	Preparation Time	Activity	Time Required for Test
Wednesday, January 22, 2003	1	15 minutes preparation and instructions	Inquiry Task	2 hours
Thursday, January 23, 2003	2	15 minutes preparation and instructions	Written Test	2.5 hours

The test must be written between 8:30 a.m. and 12:30 p.m. on Wednesday, January 22, 2003 and Thursday, January 23, 2003.

The total writing time is 2 hours for the Inquiry Task and 2.5 hours for the Written Test plus 15 minutes for preparations and instructions before each test session.

Policies for Standards Tests

Principals and supervising teachers should be aware that *Policies and Procedures for Standards Tests* handbook has been distributed to all schools and is available at http://www.edu.gov.mb.ca/ks4/assess/publications.html. This handbook outlines current policies and procedures related to the administration of standards tests and reflects the principles and guidelines contained in *Principles for Fair Student Assessment Practices for Education in Canada (1993)*.

Adaptations

Schools are asked to identify and submit requests for test adaptations **at the time of student registration**. These requests should be submitted on the *Request for Adaptations Form* included with the registration package. Following departmental review of the adaptation requests received, schools will be advised of the department's decision regarding these requests. (See *Policies and Procedures for Standards Tests*, Sections 4.0, 4.1 and 4.2.)

Exemptions

Decisions for student exemptions that fall within the guidelines set out in *Policies and Procedures for Standards Tests* (Sections 5.0, 5.1 and 5.2) are made at the school level and do not require departmental approval. Schools are required, however, to report school-based exemptions on the *Student Exemption Report* included with the registration package. If additional student exemptions are needed after the registration deadline date, an additional *Student Exemption Report* should be submitted as soon as possible.

For exemptions that fall outside the parameters of policy and procedure guidelines, requests should be made **at the time of student registration**. Please submit requests in writing to Ernest Molgat, Director, Assessment and Evaluation Branch, 71–1567 Dublin Avenue, Winnipeg MB R3E 3J5.

Re-read provisions

As the reporting of individual student scores on locally-marked standards tests is the responsibility of each local jurisdiction, the re-read policy for these tests is determined locally. Should a re-read be required for a test booklet that has been sent to the department as a part of the feedback marking process, the department will return a photocopy of the test booklet upon request. Please contact Brenda Brokenshire, Administrative Officer, at 945-5114, or toll-free at 1 800 282-8069, extension 5114.

Return of tests to students

Local jurisdictions decide whether to keep the test booklets or return them to students. The department will return the random sample of test booklets to schools within three months of marking.

Test confidentiality

Test materials must be kept secure and sealed until administration.

After each session, all materials are returned for safe-keeping to the secure area.

Test booklets must not be reproduced nor information from them communicated in any way until test administration is completed.

The *Marking Guides* are to be stored in a secure location until the test administration is complete.

Student materials

Students may use the following materials during the Senior 4 Applied Mathematics (40S) Standards Test:

- HB lead pencil;
- eraser;
- ruler;
- protractor;
- extra piece of 8 ½ × 11 blank paper and/or 0.5 cm graphing paper provided by the classroom teacher during the test sessions upon request;
- graphing calculator; and
- computer software for either the Written Test or Inquiry Task session.

Students are not permitted to exchange materials during the test.

Please note that students may choose to print their responses from the computer. In such cases, students are to indicate their booklet ID number on each page and remain seated at all times. You are responsible for distributing the printouts to them according to booklet ID number, so they can staple them appropriately to their booklets.

The following materials must **not** be used during the test:

- personal notes;
- textbooks; or
- dictionaries.

Students leaving the room

Students are expected to remain in the room for a minimum of 60 minutes from the start of each test session.

However, any student who must leave and re-enter the room should be accompanied by a replacement supervisor. This practice ensures that the supervising teacher can remain in the test room with the students at all times.

Late arrivals

Students who arrive more than one hour after the test has started will not be allowed to write the test. Students who arrive late but within the first hour of the test will be allowed to write. In this case, the student will be allowed additional time corresponding to the amount of time by which the student was late.

Student absences

Standards tests cannot be written at a later date and reported as a standards test result. Therefore, schools have the responsibility to provide a final mark to absent students. The final mark for these students must be identified as the result of a school-based assessment and evaluation practice only. (See *Policies and Procedures for Standards Tests*, Sections 6.0, 6.1 and 6.2, for additional information.)

Responding to student questions

Avoid making any directing/guiding comments during the test, other than those required for distribution of materials and instructions to students.

No explanations, translations, rephrasing, clarifying statements or comments of a similar nature may be provided about the test content.

If a student asks a question related to test content, a suggested response is, "I'm sorry. I can't answer your question. Do your best with it."

Suspected errors in printing or wording should not be communicated to students unless specific instructions are received from the Assessment and Evaluation Branch. However, you can contact Ken Clark, Assessment Consultant, at 945-3666 or toll-free at 1 800 282-8069, extension 3666 to report such errors.

Violation of rules

The *Inquiry Task Session Rules* or the *Written Test Session Rules* are read aloud to students by the supervising teacher immediately before each session of the test. (See Appendices 1 and 2, p. 19 and 20.)

Document any violation of rules on the *Supervising Teacher Report*. This documentation should include:

- the test booklet number;
- a description of the circumstances, including available evidence.

The student may be permitted to complete the test.

The consequences of any violation of rules are a local decision.

Damaged or misprinted material

Students should be assured that they will not be penalized for any obvious error in printing or wording. Local marking co-ordinators will be advised of any known errors before the marking session. Return the unused damaged booklet(s) with the reports and forms being sent to the department immediately after the final test session.

On test administration date

If a damaged or imperfectly printed test booklet is discovered **at the start** of the test session:

- replace the defective test booklet with a new test booklet; and
- print "DAMAGED" on the test booklet cover and on the *Attendance Form*.

During test administration

If a damaged or imperfectly printed test booklet is discovered **during** the writing of the test:

- give the student a new test booklet (the student keeps the damaged test booklet until the end of the session);
- instruct the student to continue responding to test items in the new test booklet;
- collect both test booklets at the end of the test session;

- cross out the existing booklet number on the undamaged test booklet and change it to the original booklet number so that **all student responses are recorded under the original booklet number**;
- indicate on the *Attendance Form* that two booklets have been used for one student (see Appendix 4, p. 22);
- record the defective test booklet number on the *Supervising Teacher Report*; and
- ensure both booklets are kept together by bundling with an elastic band.

Responsibilities of School Principals

It is the responsibility of the principals to ensure that the tests are kept confidential until test administration is completed.

Other responsibilities are listed below.

If tests are not in your school by January 13, 2003:

- public school principals should contact their superintendent;
- principals of independent and band-operated schools should contact Brenda Brokenshire, Administrative Officer, at 945-5114, or toll-free at 1 800 282-8069, extension 5114.

Use the *Packing List* to confirm that all materials have been received. Count the shrink-wrapped test booklets to ensure that there are enough booklets for the number of students writing the test. Keep the shrink-wrapped test packages unopened until the morning of the test. If additional test materials are needed, immediately contact Brenda Brokenshire, Administrative Officer at the number noted above.

Please note that the shrink-wrapped test bundles are divided into two packages. The Inquiry Task package should be opened on January 22, 2003 in preparation for the beginning of the Inquiry Task session.

The Written Test package should remain unopened in a secure location until the morning of January 23, 2003, at which time the Written Test will be administered.

Store test materials in a secure area in the school.

Provide supervising teachers with a listing of the Manitoba Education and Youth (MET) numbers for the students registered to write the test. Call the Professional Certification and Student Records Unit at 1 800 667-2378 to obtain MET numbers for new students.

Make arrangements to meet the requirements of the adaptations approved for your students. (See Adaptations, p. 3 and *Policies and Procedures for Standards Tests*, Sections 4.0, 4.1 and 4.2.)

Co-ordinate test scheduling and space requirements.

Minimize the frequency of school announcements during the test sessions.

Ensure that a replacement supervisor is available to accompany students who must temporarily leave the room.

Provide the test materials to the supervising teacher on each morning of the test.

Advise the Assessment and Evaluation Branch of school closures or suspended school bus transportation services that occur on the test dates as a result of unusual or extenuating circumstances or inclement weather conditions. Please contact Ken Clark, Assessment Consultant, at 945-3666 or toll-free at 1 800 282-8069, extension 3666.

Complete the *Principal Feedback Form* before the end of the final test session.

Responsibilities of Supervising Teachers

Supervising teachers administer the test using the step-by-step procedures outlined in the following section ("Checklist of Procedures") in this manual.

Points to Remember

- Remain in the classroom throughout the entire test session and engage in work solely related to the duties of supervising the test.
- A replacement supervisor must be available to assist you.
- Store all documents not in use in a secure area in the school.
- Ensure that once a booklet number has been assigned to a student, all materials distributed to that student have the same booklet number.
- Students may **not** have access to their test booklets between sessions.
- Students may **not** bring anything produced outside of class into the test sessions.
- Students may not review or complete work from any previous session.

In the "Checklist of Procedures", shaded areas indicate the step is not applicable for that session.

Checklist of Procedures

Session 1	Session 2	
		Advance Preparations
		1. Check with your principal to ensure that:
		• appropriate scheduling and space allocation for the test has occurred.
		• the test materials itemized on the *Packing List* have been inventoried.
		• a replacement supervisor is available to accompany students who must temporarily leave the room during the test.
		• arrangements have been made to accommodate the adaptations approved for students.
		• a list of MET numbers for students writing the test is available.
		2. Ensure that all subject-related materials have been removed from the walls and boards.
		3. Notify students in advance of the:
		• time, location and duration of each test session;
		• materials needed to write the test;
		• *Inquiry Task Session Rules* and the *Written Test Session Rules* (see Appendices 1 and 2, pp. 19 and 20); and
		• requirement to remain in the test session for at least 60 minutes.
		4. Ensure that you have extra supplies and that there is a functioning pencil sharpener and stapler in the room. Students must not exchange materials during the test. If students print their responses from the computer, they should remain seated. Distribute the printouts to them according to booklet ID numbers identified on each page of the printout.
		5. If there is more than one teacher supervising the test, photocopy the *Supervising Teacher Report*.
		6. Review the sample forms in the Appendices.
		Prior to the test session
		1. Ensure that your materials are available:
		• *Packing List*;
		• *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklets;
		• *Senior 4 Applied Mathematics (40S) Standards Test—Written Test* booklets;
		• *Attendance Forms* (enclosed with shrink-wrapped test booklets);
		• *Student Registration Update Form*;
		• four extra copies of Inquiry Task booklets;
		• four extra copies of Written Test booklets;
		• *Demographic Data Forms*;

Session 1	Session 2	
■		• *Answer/Scoring Sheets* (for the Written Test);
	■	• *Recording Sheets* (for recording marks for the Inquiry Task) (Keep in a secure location and forward to marking site (if applicable) with test materials on January 23, 2003);
		• *Supervising Teacher Report*;
		• *Supervising Teacher Feedback Form*;
		• *Principal Feedback Form* (this must be given to the principal and collected before returning materials);
		• *Administration Manual for Supervising Teachers* (this document); and
		• Xpresspost Flexipack envelope (for schools outside the city of Winnipeg) for return of materials to the Assessment and Evaluation Branch.
		2. Before opening the shrink-wrapped packages, ensure that you have the appropriate test booklets for the program being taught (e.g., French Immersion).
		3. Count the number of *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklets (Day 1) and *Written Test* booklets (Day 2). The number of test booklets should equal the number requested by the school plus the additional booklets. The number of booklets should also be identical to the number on the *Packing List*. If you need to split a bundle of booklets between classrooms, make a photocopy of the *Attendance Form* enclosed with the bundle. **On your copy**, cross out the test booklet numbers that are not used in your classroom and forward these booklets to the supervising teacher who requires them.
		4. Arrange the desks so they are spaced as far apart as possible.
		5. Ensure that students exempted from writing the test are not present.
		Beginning the test session
		1. Distribute:
	■	• *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklet
■		• *Senior 4 Applied Mathematics (40S) Standards Test—Written Test* booklet
■		• *Answer/Scoring Sheets*
		• *Demographic Data Forms* (as needed in Session 2)
■		2. Remind students to check that the number on the *Answer/Scoring Sheet* corresponds to the number on their *Senior 4 Applied Mathematics (40S) Standards Test—Written Test* booklet.
		3. Tell students that while they are working you will:
	■	• be circulating the *Attendance Form* so they can print their names beside their test booklet number;
	■	• tell them and write on the board the time and location of the Written Test.

Session 1	Session 2	
■		4. Ensure that each student receives the correct test booklet by verifying that the test booklet number corresponds to the student name recorded on the *Attendance Form*.
	■	5. Read instructions for completing *Demographic Data Forms* printed on the top left corner. Direct students to print and shade in all the information requested on the *Demographic Data Form*. Remind students of the importance of accurately recording the program (English, French Immersion or Français) they are now in.
		6. Collect the *Demographic Data Forms* (as needed in Session 2).
	■	7. Read aloud *Inquiry Task Session Rules* (Appendix 1, p. 19) to students.
■		8. Read aloud *Written Test Session Rules* (Appendix 2, p. 20) to students.
	■	9. Read aloud "Description" and "Test Resources and Directions" from Inquiry Task booklet to students (page 3 in test booklet).
■		10. Read aloud "Description" and "Test Resources and Directions" from Written Test booklet to students (inside cover in test booklet as well as the directions on page 9).
		11. Remind students to:
		• pace themselves in writing the test;
■		• use the *Answer/Scoring Sheet* for responding to multiple-choice questions; and
		• check over their work to ensure that all questions have been attempted.
		12. **Instruct students to turn the page and begin. Record the start time on the *Supervising Teacher Report*.**
		During the test session
		1. Supervise the completion of the *Attendance Form* by ensuring that students print their name beside their test booklet number. Under "Student Attendance During Test Sessions", record a "✓" for present. The names of absent students should be written on the *Attendance Form* so that these students will have a booklet number for the Written Test session of the test. Indicate that the student is absent by recording an "A" on the *Attendance Form* (see *Sample Attendance Form*, Appendix 4, p. 22). **Note:** This is the only record connecting students' identities to their Senior 4 Applied Mathematics (40S) Standards Test booklet.
■		2. Ensure that each student absent for the first test session completes a *Demographic Data Form*.
		3. Verify that all the information on each *Demographic Data Form* is accurately printed and shaded. Place all used forms in numerical order (by booklet number) followed by any unused forms in the labelled envelope provided. Do not use elastic bands, staples or paper clips on these forms as they may damage the sheets. Do not seal the envelope.
		4. Half-way through the test session, advise students of the amount of time remaining by making an announcement and writing the remaining time on a board.

Session 1	Session 2	Ending the test session
		1. Collect the test booklets from each student. Extra paper printed out or used by a student must be stapled in the booklet at the appropriate page.
		2. Have students place their *Answer/Scoring Sheet* inside the front cover of the test booklet. Extra paper printed out or used by a student must be stapled in the booklet at the appropriate page (or onto the back page if used for miscellaneous calculations). Collect the test booklets from each student.
		3. As students submit their test materials, ensure that each test booklet number matches the information on the *Attendance Form*, the *Demographic Data Form* and the *Answer/Scoring Sheet* (as applicable) (e.g., cross-reference student name and test booklet number). Each student must have the same booklet number on all test materials.
		4. Place a check "✔" on the *Attendance Form* in the "Booklet Submitted to LMC* for Marking" column.
		5. **Record the time students finish writing the test on the *Supervising Teacher Report*.** Do not include extra time given for late arrivals or adaptations.
		6. Stack the test booklets in numerical order.
		7. If marking is to be conducted at a central location, place all used *Answer/Scoring Sheets* in numerical order followed by any unused forms. Place these forms in the labelled envelope provided. Do not seal the envelope.
		8. Complete the *Supervising Teacher Report*. Note any unusual circumstances on this report.
		9. Ensure that the number of check marks in the "Booklet Submitted to LMC* for Marking" column on the *Attendance Forms* matches your count of the booklets and *Answer/Scoring Sheets* (as applicable) for submission.
		10. Complete and check the *Student Registration Update* form. Use the reason codes (Appendix 5, p. 23) provided.
		11. Make one or two copies of the *Attendance Forms* and *Supervising Teacher Report*. One copy must be retained by the school and one forwarded to the local marking site, if a centralized model is used.
		12. Collect the *Principal Feedback Form*.
		13. Complete the *Supervising Teacher Feedback Form*.
		14. Return all test booklets and other test-related materials to the **secure area** in the school until commencement of marking or until materials are to be forwarded to the local marking site.
		15. Send materials according to the instructions on the following pages.

* Local Marking Co-ordinator

Submitting Test Materials

Schools may use a variety of marking models for the Senior 4 Applied Mathematics (40S) Standards Test. The shipping directions for test materials are specific to the marking model used.

Centralized Marking (Inquiry Task and Written Test scored at a central location)

Before marking

It is essential that the following materials are packaged and forwarded **to the local marking site** immediately after completion of the Written Test on January 23, 2003:

- **all used** test booklets (for the Inquiry Task and the Written Test);
- **all used** *Answer/Scoring Sheets*;
- all *Recording Sheets*;
- copy of the *Attendance Forms*; and
- copy of the *Supervising Teacher Report*.

All other documentation should be verified and returned **to the Assessment and Evaluation Branch** by the supervising teacher after completion of the Written Test on January 23, 2003.

- **all original** *Attendance Forms*;
- **all used** *Demographic Data Forms* (in envelope provided);
- *Student Registration Update Form*;
- *Supervising Teacher Report*;
- *Supervising Teacher Feedback Form*;
- *Principal Feedback Form*; and
- all damaged or misprinted booklets.

Schools in the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch in the following way. Mid-Canada Courier is scheduled to pick up envelopes between **1:00 p.m. and 4:00 p.m.** on **January 23, 2003**. Call Mid-Canada Courier at 989-5630 when your envelope is ready. (See section "Shipping materials to the department", p. 14).

Schools outside the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch by using the Xpresspost Flexipack envelope provided and taking it to the post office.

After marking

When local marking is done at a central location, the Local Marking Co-ordinator is responsible for sending the materials to Assessment and Evaluation.

After local marking is completed for both components of the standards test, prepare a package for return to Assessment and Evaluation no later than February 3, 2003.

The package must include:

- **all** *Answer/Scoring Sheets* and *Recording Sheets*;
- test booklets (two per student: an Inquiry Task and a Written Test) requested by the department for the feedback marking;
- *Sample Request List*; and
- *Local Marking Co-ordinator Feedback Form.*

School-based and Classroom-based Marking (Inquiry Task and Written Test scored by classroom teacher)

When local marking is done at the classroom level, the teacher is responsible for sending the materials to the Assessment and Evaluation Branch.

After local marking is completed for both components of the standards test, prepare a package for return to the Assessment and Evaluation Branch no later than February 3, 2003.

The package must include:

- **all original** *Attendance Forms*;
- **all used** *Demographic Data Forms*;
- *Student Registration Update Form*;
- *Supervising Teacher Report*;
- *Supervising Teacher Feedback Form*;
- *Principal Feedback Form*;
- **all** *Answer/Scoring Sheets* and *Recording Sheets*;
- test booklets (two per student: an Inquiry Task and a Written Test) requested by the department for the feedback marking;
- *Sample Request List*;
- *Local Marking Co-ordinator Feedback Form*; and
- all damaged or misprinted booklets.

Shipping materials to the department

Jurisdictions within the City of Winnipeg send packages directly to the Assessment and Evaluation Branch via Mid-Canada Courier (989-5630). The person placing the call should quote **account number E901,** give the jurisdiction name, address, and the name of the contact person.

Jurisdictions outside the City of Winnipeg return their package by Xpresspost. It is very important to package all materials in **one Xpresspost Flexipack envelope** whenever possible.

After the package is sealed, deliver it to the local post office.

We have provided sufficient materials for the return of **one** envelope/package. If you must send a second envelope/package, photocopy the mailing address label and affix the copy to the second package. Note you must use a photocopy of the mailing address label as it provides Canada Post with billing information. Ask the postal clerk for an additional bar code label to attach to the second envelope/package. Ensure that the school representative retains the bar code number in case tracing the package is required.

Return all local marking scan sheets. Payments will be made according to the number of tests marked, based on the local marking scan sheets received.

Appendices

Appendix 1: Inquiry Task Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Inquiry Task session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully. Make sure that it is entitled *Senior 4 Applied Mathematics (40S) Standard Test—Inquiry Task*. Verify that the test booklet number matches the number you have recorded on your *Demographic Data Form*.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or imperfectly printed booklet, ask for another booklet.
- You will not be permitted to leave the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should have only the test booklet for the Inquiry Task, *Demographic Data Form*, an HB pencil, eraser, ruler, protractor, and your graphing calculator or computer. If you need extra paper to show your work, please raise your hand and I will bring it to you. To write the test, you may use only the materials previously listed. **No** other materials are permitted. Do not exchange test materials.
- If you choose to print your answers from the computer, ensure your booklet ID number appears on each page. Remain seated and I will distribute the printouts to you.
- You will not give assistance to, nor receive assistance from, another student. If you require something during the test, raise your hand and I will come to you.
- Do not ask questions or request explanations with regard to the content of the questions on the test.
- Do **not** identify yourself or your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact except for the perforated *Formula Sheet*. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

Appendix 2: Written Test Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Written Test session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully. Make sure that it is entitled *Senior 4 Applied Mathematics (40S) Standard Test— Written Test*. Verify that the test booklet number matches the number on your *Answer/Scoring Sheet*.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or imperfectly printed booklet, ask for another booklet.
- You will not be permitted to leave the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should have only the test booklet for the Written Test, the *Answer/Scoring Sheet*, an HB pencil, eraser, ruler, protractor, and your graphing calculator or computer. If you need extra paper to show your work, please raise your hand and I will bring it to you. To write the test, you may use only the materials previously listed. **No** other materials are permitted. Do not exchange test materials.
- If you choose to print your answers from the computer, ensure your booklet ID number appears on each page. Remain seated and I will distribute the printouts to you.
- Rough calculations may be done in your booklet on the pages which state: "No marks will be awarded for work done on this page." These pages are located at the back of the test booklet.
- You will not give assistance to, nor receive assistance from, another student. If you require something during the test, raise your hand and I will come to you.
- Do not ask questions or request explanations with regard to the content of the questions on the test.
- Do **not** identify yourself or your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact except for the perforated *Formula Sheet*. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

Appendix 3: Sample Generic Demographic Data Form

DEMOGRAPHIC DATA FORM

Manitoba Education, Training and Youth

NAME (Last)

NAME (First)

INSTRUCTIONS

- Use an HB pencil only.
- Do not use ink, ballpoint, or felt tip pens.
- Shade the circle completely.
- Erase cleanly any marks you wish to change.
- Do not mark other areas on this form.

EXAMPLES

INCORRECT CORRECT

PROGRAM INFORMATION

- E English Program
- 1 French Immersion Program
- F Français Program

PROVINCIAL STUDENT (MET) NO.

BIRTH DATE

MONTH: Jan, Feb, Mar, Apr, May, June, July, Aug, Sept, Oct, Nov, Dec

DAY

YEAR

BOOKLET NO.

SCHOOL CODE

Appendix 4: Sample Attendance Form

Page _____ of _____

ATTENDANCE FORM—January 2003

Senior 4 Applied Mathematics (40S) Standards Test

Booklet Number	Student Name (*Please Print*)	Student Attendance During Test Sessions		Inquiry Task Booklet Submitted to LMC* for Marking (*check* ✓)	Written Test Booklet Submitted to LMC* for Marking (*check* ✓)
		Inquiry Task	Written Test		
10001	Sandra Jones	✓	✓	✓	✓
10002	Kevin Melnychuk	✓	A	✓	
10003	DAMAGED				
10004	Dallas Severn (also 10008)	✓	✓	✓	✓
10005	David Cameron	A	✓		✓
10006	Robert Smith	A	A		
10007	UNUSED				
~~10008~~	Used with 10004 (damaged)				
~~10009~~	Used in another classroom				
~~10010~~	Used in another classroom				

NOTE: Record a "✓" for Present. An "A" indicates a student is Absent.

Karen Booth

Supervising Teacher's Name (*please print*)

Please ensure that copies of these forms are retained for your records. You will need this form to link your locally marked test with a student's name.

*** Local Marking Co-ordinator**

Appendix 5: List of Reason Codes to Record Changes in Standards Test Student Registration Numbers

(Please use these codes to complete the *Student Registration Update* when returning to the Assessment and Evaluation Branch in JANUARY 2003.)

Absent	
01	arrived too late to write the test
02	did not write due to weather
03	family/personal reasons
04	medical/illness/accident
05	out-of-town activity (athletic/academic)
06	religious objections
07	student refused to write
08	unexcused
09	working
19	other (please specify)

Withdrawn	
22	dropped course
23	incarcerated/court
24	medical/illness/accident
25	family/personal reasons
26	poor attendance/progress
27	quit school
29	other (please specify)

Incomplete	
40	continuing course/program next semester
41	no work completed
49	other (please specify)

Errors in Registration	
20	changed program
21	deceased
50	already has credit
51	auditing the course
52	exchange student
53	registered twice
54	quarter system projected registration
55	registered in wrong grade
59	other (please specify)

Exemptions	
60	emotional/psychological condition or circumstances
61	"M" credit designation
62	"E" credit designation
63	"phase d'accueil—bloc intensif" designation
69	other (please specify)

Drop Ins	
70	forgotten on original test registration
71	late registration to course
72	transferred in from another school/province/country
73	re-write (not currently enrolled)
79	other (please specify)

Migrancy	
90	transferred to another school within the province
91	transferred to another school outside of the province
99	other (please specify)

Senior 4 Applied Mathematics (40S)
Standards Test

Inquiry Task

January 2003

Manitoba
Education
and Youth

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Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{o}{h} \qquad \cos x = \frac{a}{h} \qquad \tan x = \frac{o}{a}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$P(A') = 1 - P(A)$$

$$P(\text{success}) = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A) \times P(B)$$

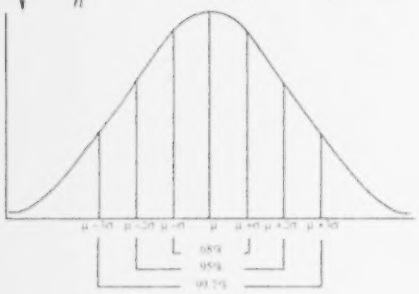
$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area $= \ell \times w$

Circle: Area $= \pi r^2$ Circumference $= 2\pi r$

Triangle: Area $= \frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area $= \left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area $= Ph + 2B$

Volume $= B \times h$

Pyramid: Volume $= \frac{B \times h}{3}$

Sphere: Volume $= \frac{4}{3}\pi r^3$ Surface area $= 4\pi r^2$

Cylinder: Volume $= \pi r^2 h$ Surface area $= 2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx - c) + d$$

$$y = a\cos(bx - c) + d$$

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 20 **Time: 2 hours**

This test consists of two tasks:

	Description	Suggested Time to Complete	Marks
Task 1	Contains questions on Design and Measurement worth 10 marks	60 minutes	10
Task 2	Contains questions on Personal Finance worth 10 marks	60 minutes	10

Test Resources and Directions

- This test should be written with the assistance of computer software and/or a graphing calculator.
- Students are provided with a formula sheet on a detachable sheet on page 1 of this booklet.
- If you use a graphing calculator, make sure you indicate all the values you entered in the space provided in this booklet.
- If you use a spreadsheet, make sure you print two copies of your spreadsheets, one showing the answers and one showing the formulas. Indicate your booklet ID number on each printout. Remain seated and your teacher will distribute these printouts to you.
- Please staple printed copies of all work done to this booklet on the page of the question. Indicate your booklet ID number on each page. Indicate in the response space of the question that the answer is on a printed sheet.
- Clearly identify the question number on your answer sheet(s) (e.g., Question 2b).

DESIGN AND MEASUREMENT

DO NOT USE

1. Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

Total: 10 marks

115

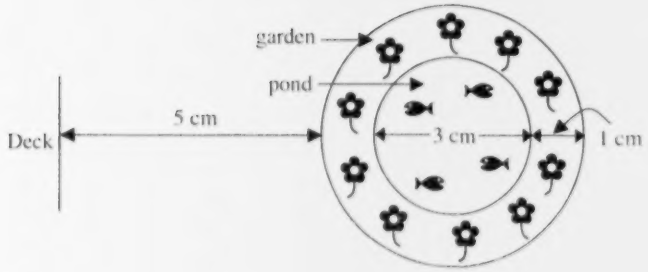
In order to create this garden, they must:

1) excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.
2) line the pond basin with a pond liner.
3) add a 2 inch layer of topsoil for the flower bed.

Supplies/services: (**must be purchased in whole units**)

Excavation: $1.49 per cubic foot plus GST only
Soil: $1.99 per $1ft.^3$ bag plus PST and GST
Pond liner: $75.00 plus PST and GST

Scale: 1 cm = 2 ft.



a) Calculate the cost of establishing the garden.

(6 marks)

DO NOT USE

Flower Garden	Pond

Total cost of flower garden and pond: _____

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" × 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)

DO NOT USE

2. In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

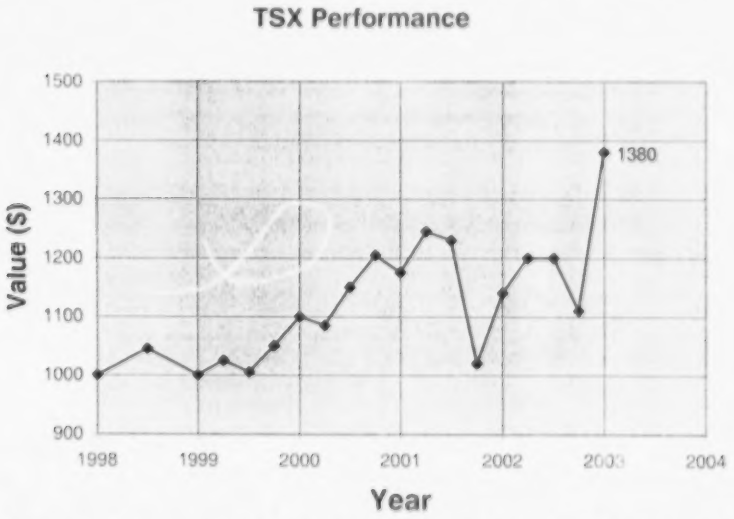
Total: 10 marks

116

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

DO NOT USE

(5 marks)

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

c) Mort and Sally have two options: to sell the house or to sell the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

END OF TEST

NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE

20028

Senior 4 Applied Mathematics (40S) Standards Test

Written Test

January 2003

Manitoba
Education
and Youth

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 61 **Time: 2.5 hours**

This test consists of two sections:

	Description	Suggested Time to Complete	Marks
Section A	10 multiple-choice questions worth 1 mark each	20 minutes	10
Section B	14 constructed-response questions worth between 2 and 6 marks each	130 minutes	51

Test Resources and Directions

- Students are provided with the Standard Normal Distribution table and a formula sheet on a detachable sheet on pages 1 and 2 of this booklet.
- Use of a graphing calculator or computer software is allowed.
- Use of protractor and ruler are required.
- Read all instructions on the test carefully.
- In Section A, choose the best response and mark it on the *Answer/Scoring Sheet*. Do not fold the *Answer/Scoring Sheet* or the test booklet.
- **If you need more space to answer a question, extra pages may be provided by your teacher. Write your booklet ID number and question number on any extra page(s) used and staple it into the booklet where your answer begins. Indicate in the response space of the question that the answer is on a separate sheet.**

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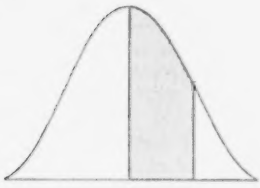
z-Score Chart



Notes:

1. For values of *z* above 3.09, use 0.4999 for the area.
2. Use these common values that result from interpolation:

z score	area
1.645	0.4500
2.575	0.4950

The Standard Normal (*z*) Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{o}{h} \quad \cos x = \frac{a}{h} \quad \tan x = \frac{o}{a}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$P(A') = 1 - P(A)$$

$$P(\text{success}) = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A) \times P(B)$$

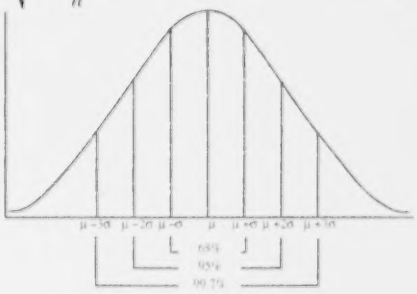
$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area = $\ell \times w$

Circle: Area = πr^2 Circumference = $2\pi r$

Triangle: Area = $\frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area = $\left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area = $Ph + 2B$

Volume = $B \times h$

Pyramid: Volume = $\frac{B \times h}{3}$

Sphere: Volume = $\frac{4}{3}\pi r^3$ Surface area = $4\pi r^2$

Cylinder: Volume = $\pi r^2 h$ Surface area = $2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx - c) + d$$

$$y = a\cos(bx - c) + d$$

SECTION A: MULTIPLE-CHOICE

Value: 10 marks **Suggested Time: 20 minutes**

1. If matrix $R = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$, then $R^2 =$

   A) $\begin{bmatrix} 3 & 2 \\ 1 & 2 \end{bmatrix}$

   B) $\begin{bmatrix} 2 & 4 \\ 2 & 0 \end{bmatrix}$

   C) $\begin{bmatrix} 3 & 1 \\ 2 & 2 \end{bmatrix}$

   D) $\begin{bmatrix} 1 & 4 \\ 1 & 0 \end{bmatrix}$

2. The dimensions of matrix $F = \begin{bmatrix} 1 & -2 & 3 \\ 0 & 4 & -3 \\ 2 & -7 & 4 \\ 8 & 0 & 1 \end{bmatrix}$ are:

   A) $\frac{4}{3}$

   B) 12

   C) 3×4

   D) 4×3

3. Identify which of the following is a scalar quantity.

A) an airplane flying 20° E of S at an airspeed of 450 km/hr

B) a person lifting a 10-kg mass upward

C) a ship sailing east at a speed of 12 knots

D) a car travelling at 100 km/hr

4. A card is drawn from a regular deck of 52 playing cards and not replaced. Then a second card is drawn. What is the probability of drawing **two kings**? Note that there are four kings in a regular deck.

A) $\frac{1}{26}$

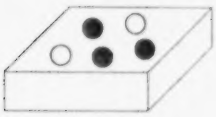
B) $\frac{1}{169}$

C) $\frac{1}{221}$

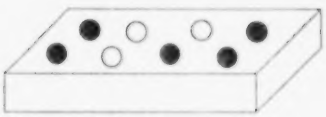
D) $\frac{3}{676}$

5. The two boxes illustrated below contain black marbles and white marbles.

box 1



box 2



One marble from box 1 and one marble from box 2 are chosen at random. What is the probability of picking two black marbles?

A) $\frac{3}{8}$

B) $\frac{8}{13}$

C) $\frac{31}{40}$

D) $\frac{49}{40}$

6. Christopher scored 82 on a recent test. The class mean for the test was 75 with a standard deviation of 2.5.

What is Christopher's z-score?

A) 52.0

B) 2.8

C) 0.4

D) −2.8

7. The following data is given:

25 30 42 50 64

Which of the following is the population standard deviation?

A) 42.2

B) 39.0

C) 15.7

D) 14.0

8. Which of the following situations would **not** produce periodic data?

A) the tides at a harbour

B) a car travelling at a constant speed on the highway

C) the number of daylight hours over a year in Manitoba

D) the motion of a pendulum in a grandfather clock

9. Which of the following periodic functions has the largest amplitude?

A) $y = 2\sin x$

B) $y = \frac{1}{2}\sin x + 4$

C) $y = 3\sin x$

D) $y = \sin 3x$

10. The following table represents data from a fractal pattern. What is the area of each new square in the 5th generation?

Generation	1st	2nd	3rd	4th	5th
Number of new squares	4	12	36		324
Area of each new square	64	16	4		?
Total area of all new squares	256	192	144		81

A) $\frac{1}{16}$

B) $\frac{1}{4}$

C) $\frac{1}{2}$

D) 1

SECTION B: CONSTRUCTED-RESPONSE

(Value: 51 marks) **(Suggested Time: 130 minutes)**

DIRECTIONS

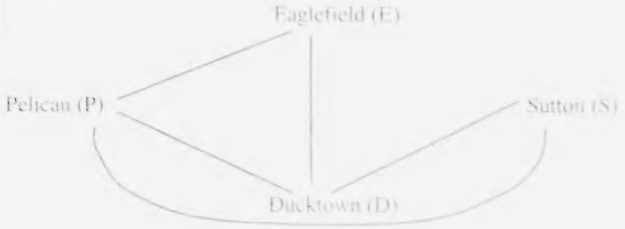
- There are 14 constructed-response questions in this section of the test. Each question is worth between 2 and 6 marks.
- Provide **complete answers** in the spaces provided in the test booklet. You may print out sketches from the computer or your calculator where applicable. Make sure these printouts contain your booklet ID number. Remain seated and your teacher will distribute these printouts to you. Staple the printouts in the booklet where the question begins. Indicate in the response space of the question that the answer is on a printed sheet.
- Provide clear explanations or justifications where applicable. This could be done through labelled diagrams, in words, by showing mathematical operations to verify your answer, or by referencing a software or a calculator program. If you reference a calculator program, indicate your input values.
- Let the mark values for each question guide your time and the amount of detail you use in your answer. Mark values for subsections of a question are indicated in parentheses.
- Round your final answers to the nearest two decimal places.
- Unless otherwise specified, it is not necessary to draw sketches to scale. If you draw a scale diagram, make sure you indicate your scale.
- An answer without any work shown will be considered incomplete.

DO NOT USE

11. The following diagram represents the roads connecting four towns.

Total: 2 marks

101



a) Create a matrix R where '1' represents a direct route between two towns and '0' represents no direct route.

(1 mark)

To:

From: $R =$	D	E	P	S
D				
E				
P				
S				

b) Create a matrix that represents the number of indirect routes you can take to go from one town to another by travelling through one other town.

(1 mark)

To:

From:	D	E	P	S
D				
E				
P				
S				

DO NOT USE

12. Lake Manitoba and Dog Lake are joined by a creek. Walleye fish will move between the lakes to reproduce. It is found that 8% of the fish in Lake Manitoba will move to Dog Lake and 12% of the fish in Dog Lake will move to Lake Manitoba.

Total: 5 marks

102

a) Create a transition matrix that illustrates the movement of the fish between lakes.

(2 marks)

b) There are presently 10 000 walleye fish in Lake Manitoba and 27 000 walleye in Dog Lake. Write this data as a row matrix.

(1 mark)

c) If the trend continues, explain what would happen in the long-term to the fish population in the two lakes. Indicate any matrices that will support your answer.

(2 marks)

13. Using the scale 1 cm = 18 km/hr, create a vector for a vehicle travelling at 72 km/hr N 20° W:

Total: 2 marks

DO NOT USE

103

DO NOT USE

104

14. A boat leaves the dock and travels a distance of 3 km in a direction W 20° S. It then changes direction and travels an additional 4.5 km in the direction E 65° S.

Total: 6 marks

a) How far is the boat from its starting point? Provide a labelled vector diagram of the situation.

(3 marks)

b) A second boat leaves the dock and travels 2 km at N 50° W. Design and draw a route for the boat to return to the dock from this point so that the total return trip is between 2.4 km and 2.8 km. Indicate all distances and directions.

(3 marks)

DO NOT USE

15. How many different security code numbers of **at least** 3 digits can be formed using the digits 1, 2, 3, and 4? No repetition is allowed.

Total: 2 marks

105

16. At a concert, the program includes three vocal presentations and two piano presentations.

Total: 3 marks

106

a) In how many ways can the program be arranged so that it includes all the presentations?

(1 mark)

b) In how many ways can the program be arranged if piano and vocal presentations alternate?

(1 mark)

c) If the order of the presentations was randomly selected, what is the probability that piano and vocal presentations would alternate? Show your work.

(1 mark)

DO NOT USE

17. A factory uses two machines to produce shovel handles. Machine A accounts for 40% of the total production while Machine B produces the rest. Machine A's production is 4% defective while Machine B's is 3% defective.

Total: 4 marks

107

a) Provide a diagram that illustrates this situation and indicate all probabilities.

(2 marks)

b) What is the probability that the factory produces a defective handle?

(1 mark)

c) If 5000 shovel handles are produced, how many would you expect to be defective?

(1 mark)

DO NOT USE

18. Mr. Kornestel had his students record their heights (in cm). These heights were normally distributed with a mean of 157 cm and a standard deviation of 8.4 cm.

Total: 4 marks

108

a) Calculate the **percentage** of students that is taller than 165 cm. Show how you arrived at your answer.

(2 marks)

b) Among the 32 students in Mr. Kornestel's class, calculate the approximate **number** of students with a height of **less** than 165 cm.

(1 mark)

c) Using your knowledge of the normal distribution, briefly explain how you would predict the approximate height of the tallest student in the class.

(1 mark)

DO NOT USE

19. The physics department at the Zenith University is considering two students for an entrance scholarship. Both students wrote the same entrance exam. In order to determine who should receive the money, the committee examines the entrance exam scores, as well as the students' performance in their Senior 4 math and physics courses.

Total: 5 marks

109

Compare the profiles of the following two candidates and decide who you would recommend.

Using the normal distribution, support your recommendation with at least 2 arguments.

Clearly state any assumptions you have made.

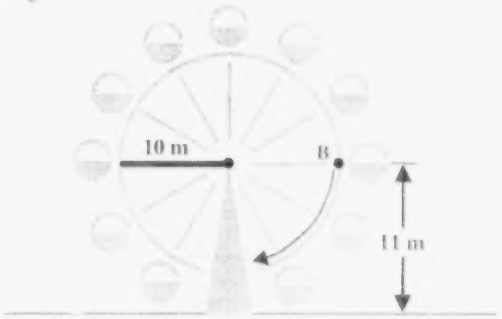
Candidates	Entrance Exam (%)	Senior 4 Physics course (%)			Senior 4 Math course (%)		
		student mark	class $\bar{x}$	class σ	student mark	class $\bar{x}$	class σ
Francine	91	93	71	8	90	65	10
Victor	95	87	68	9	94	70	9

DO NOT USE

110

20. A Ferris wheel has a radius of 10 m and turns clockwise. The distance that a passenger is from the ground varies sinusoidally with time. The Ferris wheel is shown in the following diagram:

Total: 3 marks



When the Ferris wheel is finished being loaded with passengers, Brent is at point B, 11 m off the ground. From point B, it takes Brent 30 seconds to reach the highest point on the wheel.

a) Sketch the height of B with respect to time for one revolution of the Ferris wheel. Clearly label your graph.

(2 marks)

b) State the equation that represents the rotation of the Ferris wheel.

(1 mark)

DO NOT USE

111

21. Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

Total: 5 marks

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres
and t represents the number of hours since **midnight**

a) Create a graph showing the depth of water over 24 hours.

(1 mark)

b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

DO NOT USE

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

DO NOT USE

112

22. For a particular infection, an antibiotic medication is given in the form of a 500 mg pill. One pill is taken at 8:00 a.m. each morning. By the next day, at 8:00 a.m., 25% of the antibiotic medication has been released from the body.

Total: 4 marks

a) Calculate the amount of antibiotic medication in the body at 8:00 a.m. each day, for six days.

(2 marks)

b) The same antibiotic medication is also used to fight a different infection. Suggest a way to take only six pills to achieve a level of at least 1000 mg daily in the body for more than five days. Pills can only be taken at 8:00 a.m. Partial pills can be taken. Show work to support your answer.

(2 marks)

DO NOT USE

23. In October, an oil well in Alberta produced 80 m^3 of oil. Each month, the well produces 3.1% less oil than the previous month.

Total: 3 marks

113

a) In total, how much oil will be produced during a 6-month period beginning October 1st? Show how you arrived at your answer.

(2 marks)

b) Once the well production drops below 60 m^3 per month, it is not profitable to operate the well. In which month will it no longer be profitable to operate the well?

(1 mark)

DO NOT USE

114

24. The equilateral triangle of Generation 1 measures 27 centimetres on each side. Each side has been divided into 3 equal segments. An equilateral triangle is placed on the middle segment as shown in the three generations below.

Total: 3 marks

Generation 1 Generation 2 Generation 3

Complete the chart below to show the perimeters of each of these generations and of the 4th generation.

Generation	Number of sides	Length of sides	Perimeters
1	3	27 cm	81 cm
2			
3			
4			

END OF TEST

NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE

NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE

NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE

Senior 4 Applied Mathematics (40S)
Standards Test

Marking Guide

January 2003

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Education
and Youth

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Manitoba Education and Youth,
Assessment and Evaluation Branch,
Winnipeg, Manitoba R3E 3J5.

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General Instructions

Organization of document:

Following the general instructions for marking, the document is divided into three sections:

- Answer key for multiple-choice items
- Marking keys and scoring rubrics for constructed-response items
- Marking keys and scoring rubrics for the Inquiry Task

The first section presents the answers for the multiple-choice items in a table accompanied by the learning outcome(s) associated with each item. In the second section, each test item is presented in bold characters, followed by a series of typical and possible answers. A marking key or scoring rubric details how the marks are to be allocated for each sub-section of the question. Marking keys are used to mark restricted-response items (with or without explanations). Scoring rubrics are to be used for scoring open-response items.

For each question, the item type, the maximum number of marks possible as well as the specific outcomes targeted by the item are identified at the top of the page. Items are presented in the order that they appear on the standards test. Each open-response item as well as each Inquiry Task item is followed by a series of student exemplars. Student exemplars are chosen to exemplify the use of scoring rubrics or marking keys. The mark value allocated and a rationale justifying the mark allocation accompany each student exemplar.

General Marking Instructions

Please make no marks in the test booklets.

Please ensure that:

- each student's final result is recorded, by test booklet number, on the corresponding ***Answer/Scoring Sheet*** (computer scan sheet);
- the totals are written at the bottom;
- the *Answer/Scoring Sheet* is complete and correct;
- a copy has been made for school records; and
- **only a pencil is used to complete the *Answer/Scoring Sheets*, by both students and markers.**

Once marking is completed, please forward the *Answer/Scoring Sheets* to Manitoba Education and Youth (for more information see the *Administration Manual for Supervising Teachers*).

Scoring the Multiple-choice items

Please follow the answer key provided on page 5 of this document.

Types of student errors

As a guiding principle, students should only be penalized once for each error committed in the context of a test item. For example, students may choose an inappropriate but still relevant strategy for an item but carry it through correctly and arrive at an incorrect answer. In such cases, students should be penalized for having selected an inappropriate strategy for the task at hand but should be given credit for having arrived at an answer consistent with their choice of strategy.

Please note that for all questions in the vectors unit, allow a flexibility of ±3 mm and ±3° when marking students' scale diagrams.

Throughout this document, four types of errors have been identified. These are defined briefly below:

Trivial errors:
These are errors for which no marks are to be deducted. In order to be considered trivial, an error must be conceptually unrelated to the learning outcome(s) associated with the item and not lead to a mathematically incorrect answer. Examples include omitting labels, omitting to carry a negative sign in an algebraic task or not rounding final answers.

Technical communication errors:
These are errors of mathematical notation that are conceptually related to the curriculum outcomes. It is important to note, however, that such errors do not prevent students from arriving at a mathematically correct answer. Examples include omitting to use brackets on matrices, missing more than one vector head in a response and not stating a scale when using a scale diagram as a strategy. In such cases, students are to be penalized no more than a half mark per question for each type of error.

Minor errors:
These are errors that are generally not conceptual in nature but will inevitably lead to an incorrect answer. In such cases, students are generally penalized one mark depending on the details provided in the marking key or scoring rubric.

Major errors:
These are errors or omissions that are conceptual in nature and clearly reflect a gap in the student's knowledge of the specific learning outcome(s). These types of errors often limit the number of marks that can be awarded to a student's response.

Scoring the Constructed-response items

The respective marking key or scoring rubric should be used in conjunction with the ***Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards*** (Applied section) when assigning scores to student responses.

Scoring Guidelines—Restricted-response items (with or without explanation)

Each item of this type is designed to elicit a well-defined response according to the associated specific outcome(s) and relevant mathematical processes. Their purpose is to determine whether a student meets the standards for the course (level 2) as they relate to the knowledge and skills associated with the item.

To receive full marks, a student's response must be complete and correct. Partial marks may be awarded for a "relevant strategy" with execution errors. **A relevant strategy is defined as one that is consistent with the specific outcome(s) and mathematical processes associated with the item that, if properly executed, would lead to the correct answer.** Where alternative strategies are possible, the marking key makes mention of them.

It is important to note that some items require some form of explanation or justification from students. Such explanations and justifications can take various forms depending on students' learning styles. Therefore, marking of student responses needs to reflect appropriate flexibility in this regard. Test instructions to students have clearly specified that explanations or justifications can be done through labeled diagrams, in words, by showing mathematical operations for answer verification or by referencing software or a calculator program.

Scoring Guidelines—Open-response items

These items are designed to elicit student responses at any of the three levels of achievement defined in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section). The rubrics contain the language of

the curricular standards in order to facilitate scoring in a manner that is consistent with those standards. The recommended procedure for scoring student responses is as follows:

1. Read the relevant specific outcome(s) in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section).
2. Read the possible solution(s) provided in this document.
3. Study the student exemplars provided and the rationales for the assigned scores.
4. Carefully view all of the student's response and decide which of the three levels of achievement ("exceptional understanding", "good understanding" or "limited understanding") best applies. Whether the response clearly fits into one category or straddles two, this process will narrow down the number of possible scores that can be assigned to the response.
5. Compare the features of the student's response with the general performance indicators accompanying the mark values and the specific performance indicators (criteria) contained in the rubric. Note that the specific performance indicators only typify a student's response in a given score category. An exact match is not anticipated.

Assistance

If, during marking, any issue arises that cannot be resolved locally, please call Manitoba Education and Youth at the earliest opportunity to advise and/or seek assistance. If required, we will connect you to an advisor. Also, please be sure to notify us before making any modifications to the answer/marking keys or scoring rubrics.

Contact person: Ken Clark at 945-3666 (1 800 282-8069, extension 3666).

Answer Key
for Multiple-choice items

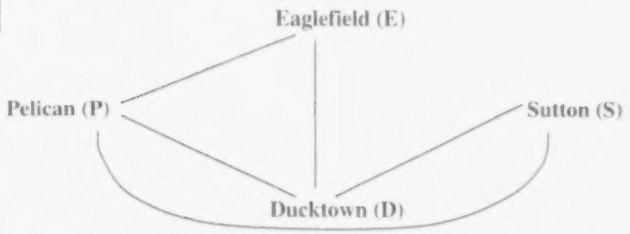
Question No.	Answer	Outcome
1	A	A2
2	D	A1
3	D	B1
4	C	D4
5	A	D3, D5
6	B	E2
7	D	E1
8	B	G1
9	C	G1
10	B	H3

Marking Keys and Scoring Rubrics for Constructed-response items

Question No. 11 and Answer

The following diagram represents the roads connecting four towns.

Total: 2 marks



a) **Create a matrix R where '1' represents a direct route between two towns and '0' represents no direct route.**

(1 mark)

$$\text{From: } R = \begin{array}{c} \\ \text{D} \\ \text{E} \\ \text{P} \\ \text{S} \end{array} \begin{array}{c} \begin{array}{cccc} \text{D} & \text{E} & \text{P} & \text{S} \end{array} \text{ To:} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

b) **Create a matrix that represents the number of indirect routes you can take to go from one town to another by travelling through one other town.**

(1 mark)

$$\text{From: } R^2 = \begin{array}{c} \\ \text{D} \\ \text{E} \\ \text{P} \\ \text{S} \end{array} \begin{array}{c} \begin{array}{cccc} \text{D} & \text{E} & \text{P} & \text{S} \end{array} \text{ To:} \\ \begin{bmatrix} 3 & 1 & 2 & 1 \\ 1 & 2 & 1 & 2 \\ 2 & 1 & 3 & 1 \\ 1 & 2 & 1 & 2 \end{bmatrix} \end{array}$$

Marker Notes:

- *Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide)*

Marking Key
1 mark for the correct answer in a) *1 mark for the correct answer in b) or answer consistent with answer in a)*

Question No. 12 and Answer

Total: 5 marks

Lake Manitoba and Dog Lake are joined by a creek. Walleye fish will move between the lakes to reproduce. It is found that 8% of the fish in Lake Manitoba will move to Dog Lake and 12% of the fish in Dog Lake will move to Lake Manitoba.

a) **Create a transition matrix that illustrates the movement of the fish between lakes.**

(2 marks)

$$T = \begin{matrix} \\ \text{M} \\ \text{D} \end{matrix} \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ \begin{bmatrix} 0.92 & 0.08 \\ 0.12 & 0.88 \end{bmatrix} \end{matrix} \quad \text{or} \quad T = \begin{matrix} \\ \text{D} \\ \text{M} \end{matrix} \begin{matrix} \begin{matrix} \text{D} & \text{M} \end{matrix} \\ \begin{bmatrix} 0.88 & 0.12 \\ 0.08 & 0.92 \end{bmatrix} \end{matrix}$$

b) **There are presently 10 000 walleye fish in Lake Manitoba and 27 000 walleye in Dog Lake. Write this data as a row matrix.**

(1 mark)

$$\text{NOW} = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [10\,000 \quad 27\,000] \end{matrix} \quad \text{or} \quad \text{NOW} = \begin{matrix} \begin{matrix} \text{D} & \text{M} \end{matrix} \\ [27\,000 \quad 10\,000] \end{matrix}$$

c) **If the trend continues, explain what would happen in the long-term to the fish population in the two lakes. Indicate any matrices that will support your answer.**

(2 marks)

The populations will stabilize at 22 200 walleye in Lake Manitoba and 14 800 walleye in Dog Lake.

$$\text{NT}^{50} = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [22\,200 \quad 14\,800] \end{matrix}$$

$$\text{NT}^{100} = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [22\,200 \quad 14\,800] \end{matrix}$$

OR

$$\text{N} * \text{T} = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [12\,440 \quad 24\,560] \end{matrix}$$

$$\text{N} * \text{T}^2 = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [14\,392 \quad 22\,608] \end{matrix} \qquad \text{N} * \text{T}^3 = \begin{matrix} \begin{matrix} \text{M} & \text{D} \end{matrix} \\ [15\,954 \quad 21\,046] \end{matrix}$$

The number of walleye fish will increase in Lake Manitoba and decrease in Dog Lake each year.

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
Level 3 exceptional understanding	**5** **complete and correct, reflecting exceptional understanding**	- 5 criteria correct

Criteria: *1) 1 mark for the correct values in the diagonal in a)*
2) 1 mark for the correct matrix with the rest of the numbers in a)
3) 1 mark for the correct answer in b)
4) 1 mark for the correct support given in c)
5) 1 mark for the correct conclusion consistent with support in c) (or consistent with answer in a) and b))

Marker Notes:

- *Not labelling is considered a trivial error.*
- *If students only show one long-term transition but demonstrate their complete understanding of long term trends in their explanation, award marks for c). In all other cases, one transition matrix is not sufficient.*
- *Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide)*

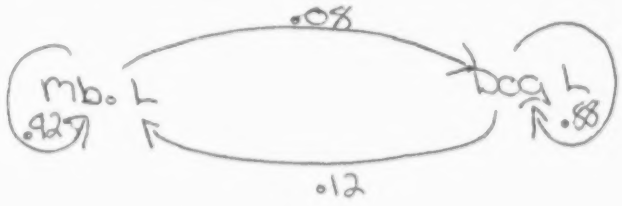
Student exemplar 1

Total: 5 marks

Lake Manitoba and Dog Lake are joined by a creek. Walleye fish will move between the lakes to reproduce. It is found that 8% of the fish in Lake Manitoba will move to Dog Lake and 12% of the fish in Dog Lake will move to Lake Manitoba.

a) Create a transition matrix that illustrates the movement of the fish between lakes.

(2 marks)



b) There are presently 10 000 walleye fish in Lake Manitoba and 27 000 walleye in Dog Lake. Write this data as a row matrix.

(1 mark)

$$R = \begin{matrix} \text{L. Mb.} & \text{Dog L.} \\ [10\,000 & 27\,000] \end{matrix}$$

c) If the trend continues, explain what would happen in the long-term to the fish population in the two lakes. Indicate any matrices that will support your answer.

(2 marks)

If this trend continues eventually the # of fish in each lake will stabilize.

2 marks:

- 1 mark for correct calculation in a), although it is not a transition matrix
- 1 mark for correct answer in b)
- The answer in c) is too general

Student exemplar 2

Total: 5 marks

Lake Manitoba and Dog Lake are joined by a creek. Walleye fish will move between the lakes to reproduce. It is found that 8% of the fish in Lake Manitoba will move to Dog Lake and 12% of the fish in Dog Lake will move to Lake Manitoba.

a) Create a transition matrix that illustrates the movement of the fish between lakes.

(2 marks)

$$T = \begin{matrix} \\ M \\ D \end{matrix}\begin{matrix} \begin{matrix} M & D \end{matrix} \\ \begin{bmatrix} 0,92 & 0,08 \\ 0,88 & 0,12 \end{bmatrix} \end{matrix}$$

b) There are presently 10 000 walleye fish in Lake Manitoba and 27 000 walleye in Dog Lake. Write this data as a row matrix.

(1 mark)

$$P = \begin{matrix} M & D \\ \begin{bmatrix} 10000 & 27000 \end{bmatrix} \end{matrix}$$

c) If the trend continues, explain what would happen in the long-term to the fish population in the two lakes. Indicate any matrices that will support your answer.

(2 marks)

$P \times T = [32960 \quad 4040]$

$$\begin{bmatrix} 10000 & 27000 \end{bmatrix} \times \begin{bmatrix} 0.92 & 0.08 \\ 0.88 & 0.12 \end{bmatrix} = \begin{matrix} \begin{matrix} M & D \end{matrix} \\ \begin{bmatrix} 32960 & 4040 \end{bmatrix} \end{matrix}$$

$P_1 = [32960 \quad 4040]$

The population would switch Lakes.

2 marks:

- 1 mark for a)
- Numbers are correct but in the wrong order in a)
- Part b) is correct
- Part c) is incomplete

Student exemplar 3

Total: 5 marks

Lake Manitoba and Dog Lake are joined by a creek. Walleye fish will move between the lakes to reproduce. It is found that 8% of the fish in Lake Manitoba will move to Dog Lake and 12% of the fish in Dog Lake will move to Lake Manitoba.

a) Create a transition matrix that illustrates the movement of the fish between lakes.

(2 marks)

$$\begin{array}{c} \\ \text{From} \end{array} \begin{array}{c} \begin{array}{cc} M & D \end{array} \text{ to} \\ \begin{bmatrix} .92 & .08 \\ .12 & .88 \end{bmatrix} \end{array} : A$$

b) There are presently 10 000 walleye fish in Lake Manitoba and 27 000 walleye in Dog Lake. Write this data as a row matrix.

(1 mark)

$$\begin{bmatrix} M & D \\ 10\,000 & 27000 \end{bmatrix} : B$$

c) If the trend continues, explain what would happen in the long-term to the fish population in the two lakes. Indicate any matrices that will support your answer.

(2 marks)

$B*A$ [12440 24560] : C

$B*A^2 = C*A$ [14392 22608] : D

$B*A^3 = D*A$ [15953.6 21046.4] : E

$B*A^4 = E*A$ [17202.88 19797.12] : F

$B*A^5 = F*A$ [18202.30 18797.70] : G

$B*A^6 = G*A$ [19001.84 17998.16] : H

$B*A^7 = H*A$ [19641.47 17358.53] ...

$B*A^{42}$ shows the final indication of the fish numbers changing from migrating. [22200 14800]

therefore the trend stops

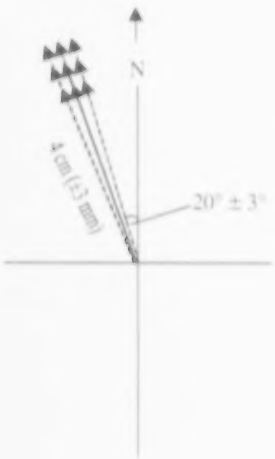
5 marks:

- Complete and correct

Question No. 13 and Answer

Using the scale 1 cm = 18 km/hr, create a vector for a vehicle travelling at 72 km/hr N 20° W:

Total: 2 marks



Marker Notes:

- *A transparency of this sheet will facilitate marking.*
- *Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide)*

Marking Key
1 mark for the correct direction given (± 3°)
1 mark for the correct distance given (± 3 mm)

Question No. 14 and Answer

A boat leaves the dock and travels a distance of 3 km in a direction W 20° S. It then changes direction and travels an additional 4.5 km in the direction E 65° S.

Total: 6 marks

a) **How far is the boat from its starting point? Provide a labelled vector diagram of the situation.**

(3 marks)

Let 1 cm = 1 km

$c^2 = a^2 + b^2 - 2ab\cos C$

$c^2 = 3^2 + 4.5^2 - 2(3)(4.5)\cos 85°$

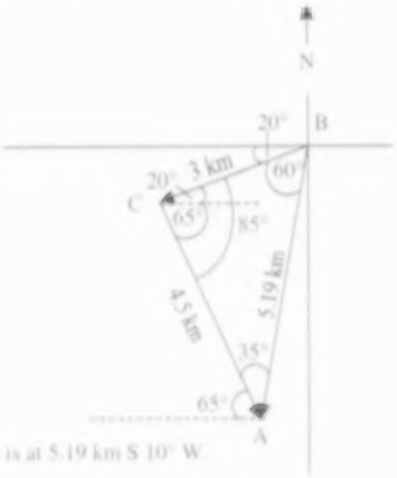
$c^2 = 26.898$

$c = 5.186$

OR

TriSolve

Input:	output:
a = 3 km	c = 5.19 km
b = 4.5 km	A = 35.2°
C = 85°	B = 59.8°

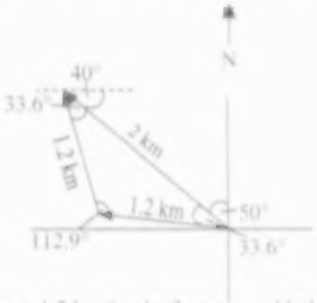


The boat is at 5.19 km S 10° W.

b) **A second boat leaves the dock and travels 2 km at N 50° W. Design and draw a route for the boat to return to the dock from this point so that the total return trip is between 2.4 km and 2.8 km. Indicate all distances and directions.**

(3 marks)

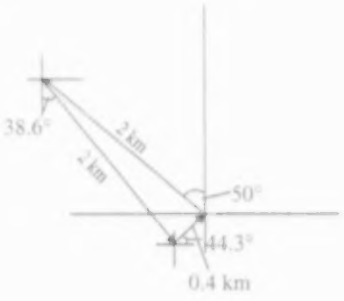
Scale: 2 cm = 1 km



Assume 1.2 km + 1.2 km for the 2 routes and let's find the angles.

To return, the boat will have to travel E 73.6° S for 1.2 km and then E 6.5° S for 1.2 km.

OR



OR

S 10.3° E for 1.3 km

E 0.3° S for 1.3 km

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
	5 **almost complete and correct**	- 5 criteria correct
Level 3 exceptional understanding	**6** **complete and correct, reflecting exceptional understanding**	- 6 criteria correct

Criteria: *1) 1 mark for the correct diagram in a)*
2) 1 mark for work shown indicating an appropriate strategy in a)
3) 1 mark for the correct resultant in a) or consistent with diagram
4) 1 mark for correctly drawing the original vector diagram in b)
5) 1 mark for correct directions and distances stated or correctly describing the vectors
6) 1 mark for a reasonable route that is between 2.4 km and 2.8 km in b)

Marker Notes:

- *Other answers possible for b)*
- *The original 2 km vector can be drawn with the arrow head on either end (towards the dock or away from the dock)*
- *Allow for ± 5 mm and ± 5° margin of error when students use scale diagrams.*
- *Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide)*

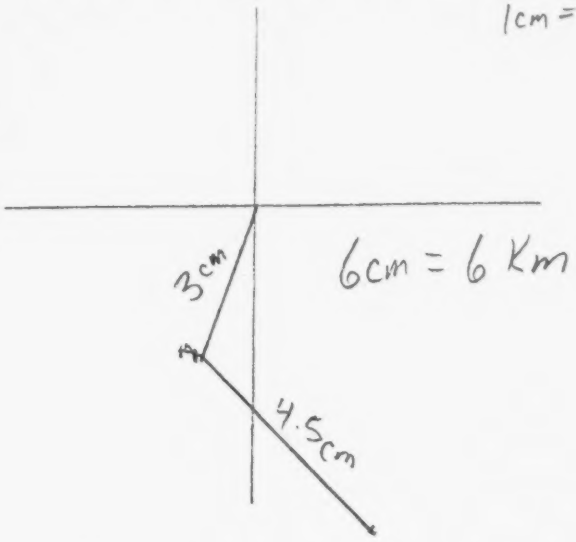
Student exemplar 1

A boat leaves the dock and travels a distance of 3 km in a direction W 20° S. It then changes direction and travels an additional 4.5 km in the direction E 65° S.

Total: 6 marks

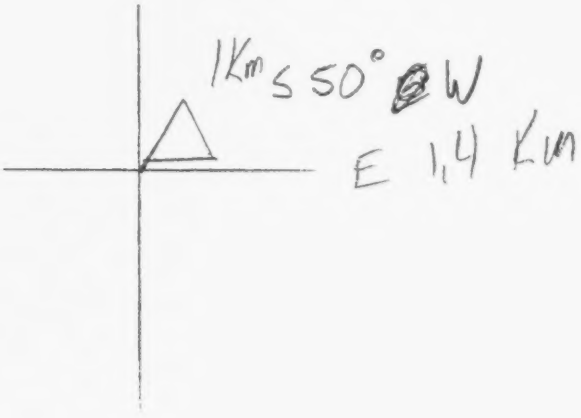
a) How far is the boat from its starting point? Provide a labelled vector diagram of the situation.

(3 marks)



b) A second boat leaves the dock and travels 2 km at N 50° W. Design and draw a route for the boat to return to the dock from this point so that the total return trip is between 2.4 km and 2.8 km. Indicate all distances and directions.

(3 marks)



0.5 mark:

- 1 mark for strategy (scale diagram) in a)
- ½ mark deduction because vector heads are missing

Student exemplar 2

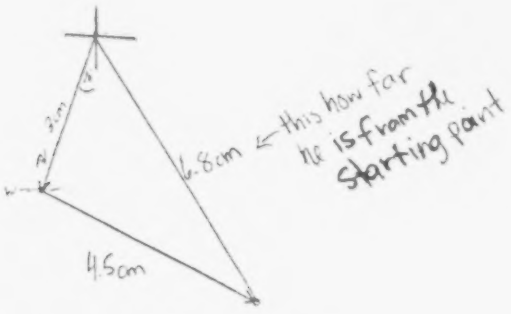
A boat leaves the dock and travels a distance of 3 km in a direction W 20° S. It then changes direction and travels an additional 4.5 km in the direction E 65° S.

Total: 6 marks

a) How far is the boat from its starting point? Provide a labelled vector diagram of the situation.

(3 marks)

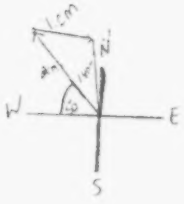
1cm=1km



b) A second boat leaves the dock and travels 2 km at N 50° W. Design and draw a route for the boat to return to the dock from this point so that the total return trip is between 2.4 km and 2.8 km. Indicate all distances and directions.

(3 marks)

1cm = 1km



1.5 marks:

- 1 mark for an appropriate strategy in a)
- 1 mark for a reasonable route in terms of distance in b)
- Diagram incorrect in b)
- ½ mark deduction because vector heads are missing

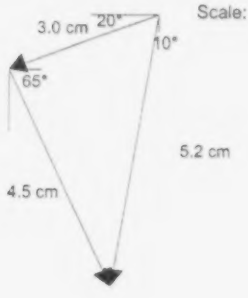
Student exemplar 3

A boat leaves the dock and travels a distance of 3 km in a direction W 20° S. It then changes direction and travels an additional 4.5 km in the direction E 65° S.

Total: 6 marks

a) How far is the boat from its starting point? Provide a labelled vector diagram of the situation.

(3 marks)



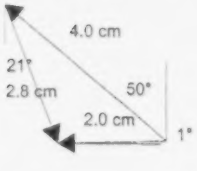
Scale: 1cm = 1km

Therefore, the boat is 5.2km away from its starting point in a direction of S10°W

b) A second boat leaves the dock and travels 2 km at N 50° W. Design and draw a route for the boat to return to the dock from this point so that the total return trip is between 2.4 km and 2.8 km. Indicate all distances and directions.

(3 marks)

Scale: 2cm = 1km



A route that is exactly 2.4km for the boat to get back to the dock would be:

2km in the direction of N50°W
1.4km in the direction of S21°E
1km in the direction of E1°N

6 marks:

- All complete and correct
- No marks deducted for the error in diagram b) (incorrect direction of resultant) because marks were awarded only for the original vector and correct description.

Specific Outcomes: D2 **Item Type: Restricted Response**

Question No. 15 and Answer

How many different security code numbers of at least 3 digits can be formed using the digits 1, 2, 3, and 4? No repetition is allowed.

Total: 2 marks

Numbers with 4 digits: $4 \times 3 \times 2 \times 1 = 24$

$+$

Numbers with 3 digits: $4 \times 3 \times 2 = 24$

$= 48$

Marker Notes:

- *Award 1 mark if student completes question with either 3 digits or 4 digits only.*

Marking Key
1 mark for work shown indicating an appropriate strategy (e.g., counting principle, diagram or listing of events) *1 mark for the correct answer*

Question No. 16 and Answer

At a concert, the program includes three vocal presentations and two piano presentations.

Total: 3 marks

a) In how many ways can the program be arranged so that it includes all the presentations?

(1 mark)

(5) (4) (3) (2) (1) = 120 outcomes

b) In how many ways can the program be arranged if piano and vocal presentations alternate?

(1 mark)

(3) (2) (2) (1) (1) = 12 outcomes

c) If the order of the presentations was randomly selected, what is the probability that piano and vocal presentations would alternate? Show your work.

(1 mark)

$$p = \frac{12}{120} = \boxed{\frac{1}{10}} \text{ or } 10\%$$

Marking Key
1 mark for the correct answer in a) *1 mark for the correct answer in b)* *1 mark for the correct answer in c) or consistent with their answer in a) and b) (i.e., dividing answer in b) by a))*

Specific Outcomes: D3, D4 Item Type: Restricted Response with Explanation

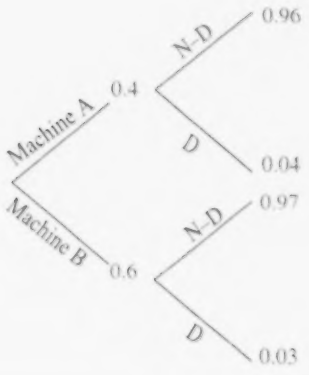
Question No. 17 and Answer

Total: 4 marks

A factory uses two machines to produce shovel handles. Machine A accounts for 40% of the total production while Machine B produces the rest. Machine A's production is 4% defective while Machine B's is 3% defective.

a) **Provide a diagram that illustrates this situation and indicate all probabilities.**

(2 marks)



b) **What is the probability that the factory produces a defective handle?**

(1 mark)

$$P(D) = (0.4 \times 0.04) + (0.6 \times 0.03) = 0.034\ (3.4\%)$$

c) **If 5000 shovel handles are produced, how many would you expect to be defective?**

(1 mark)

$$5000 \times 0.034 = 170 \text{ shovel handles}$$

Marking Key
1 mark for work shown indicating an appropriate strategy in a) (i.e., diagram or chart showing defective handles or other supportive strategy)
1 mark for the correct complementary probability calculated in a)
1 mark for a correct answer in b) or consistent with answer in a)
1 mark for the correct answer in c) or consistent with answer in b)

Question No. 18 and Answer

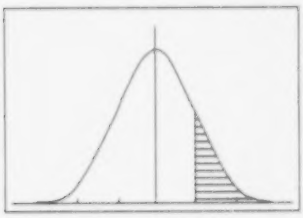
Mr. Kornestel had his students record their heights (in cm). These heights were normally distributed with a mean of 157 cm and a standard deviation of 8.4 cm.

Total: 4 marks

a) **Calculate the <u>percentage</u> of students that is taller than 165 cm. Show how you arrived at your answer.**

(2 marks)

$$z = \frac{165 - 157}{8.4} = 0.95 \qquad p(z > 0.952) = 0.5 - 0.33$$
$$= 0.17 \text{ or } 17\%$$



157 165

Found z-score and then looked up in the normal distribution table.

OR

Normal CDF (165, E99, 157, 8.4) → 0.17

b) **Among the 32 students in Mr. Kornestel's class, calculate the approximate <u>number</u> of students with a height of <u>less</u> than 165 cm.**

(1 mark)

p (< 165 cm) = 1 – 0.17 = 0.83 or 83%
number of students: 32 (0.83) = 26.56
= 26 or 27 students

OR

Normal CDF (-E99, 165, 157, 8.4) = 0.83 × 32 = 27 students

c) **Using your knowledge of the normal distribution, briefly explain how you would predict the approximate height of the tallest student in the class.**

(1 mark)

157 + 3(8.4) = 182 cm

I chose 3 standards deviations above the mean as a reasonable estimate of the tallest student in the class. He or she would be about 182 cm tall.

OR

Inv. Normal CDF (31/32, 157, 8.4) = 172.64 cm

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
Level 2 good understanding	**2** **reasonable attempt, appropriate strategy, minor errors and/or omissions**	- 2 criteria correct
	3 **complete and correct with minor errors**	- 3 criteria correct
Level 3 exceptional understanding	**4** **complete and correct, reflecting exceptional understanding**	- 4 criteria correct

Criteria:

1) 1 mark for work shown indicating an appropriate strategy in a) (e.g., finding the z-score using normal CDF, using spreadsheets or z-score tables)
2) 1 mark for the correct answer in a) (i.e., converting the z-score to probability/percentage)
3) 1 mark for the correct answer in b) or consistent with answer in a)
4) 1 mark for the correct answer in c)

Student exemplar 1

Mr. Kornestel had his students record their heights (in cm). These heights were normally distributed with a mean of 157 cm and a standard deviation of 8.4 cm.

Total: 4 marks

a) Calculate the **percentage** of students that is taller than 165 cm. Show how you arrived at your answer.

(2 marks)

$\frac{(166-157\text{cm})}{8.4} = 0.9538 =$ 95.24%

b) Among the 32 students in Mr. Kornestel's class, calculate the approximate **number** of students with a height of **less** than 165 cm.

(1 mark)

32 / 95.24 = .33599 = 33.60%

32 x 033599 So Roughly 10.755 students

c) Using your knowledge of the normal distribution, briefly explain how you would predict the approximate height of the tallest student in the class.

(1 mark)

1 mark:

- Strategy (z-score) is correct in a)

Student exemplar 2

Mr. Kornestel had his students record their heights (in cm). These heights were normally distributed with a mean of 157 cm and a standard deviation of 8.4 cm.

Total: 4 marks

a) Calculate the **percentage** of students that is taller than 165 cm. Show how you arrived at your answer.

(2 marks)

$z = \frac{165 - 157}{8.4}$

$z = .95$

95% of the students are taller than 165 cm.

b) Among the 32 students in Mr. Kornestel's class, calculate the approximate **number** of students with a height of **less** than 165 cm.

(1 mark)

$(32)(.95) = 30.4$

30 students have a height less than 165 cm.

c) Using your knowledge of the normal distribution, briefly explain how you would predict the approximate height of the tallest student in the class.

(1 mark)

2 marks:

- 1 mark for correct strategy in a)
- 1 mark for correct answer in b), consistent with a)

Student exemplar 3

Mr. Kornestel had his students record their heights (in cm). These heights were normally distributed with a mean of 157 cm and a standard deviation of 8.4 cm.

Total: 4 marks

a) Calculate the **percentage** of students that is taller than 165 cm. Show how you arrived at your answer.

(2 marks)

$z = \frac{165 - 157}{8.4} = .952$

50% - 33% = 17%

17% are taller than 165 cm

b) Among the 32 students in Mr. Kornestel's class, calculate the approximate **number** of students with a height of **less** than 165 cm.

(1 mark)

50% + 33% = 83%

32 x .83 = 27 students

c) Using your knowledge of the normal distribution, briefly explain how you would predict the approximate height of the tallest student in the class.

(1 mark)

figure out what percentage one student is of the class, figure out their z-score using the table, and then work backwards using the z-score equation.

3 marks:

- Explanation in c) is unclear

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Specific Outcomes: E1, E2, E3 **Item Type: Open Response**

Question No. 19 and Answer

Total: 5 marks

The physics department at the Zenith University is considering two students for an entrance scholarship. Both students wrote the same entrance exam. In order to determine who should receive the money, the committee examines the entrance exam scores, as well as the students' performance in their Senior 4 math and physics courses.

Compare the profiles of the following two candidates and decide who you would recommend.

Using the normal distribution, support your recommendation with at least 2 arguments.

Clearly state any assumptions you have made.

Candidates	Entrance Exam (%)	Senior 4 Physics course (%)			Senior 4 Math course (%)		
		student mark	class $\bar{x}$	class σ	student mark	class $\bar{x}$	class σ
Francine	91	93	71	8	90	65	10
Victor	95	87	68	9	94	70	9

Francine:

$$\text{Physics: } z = \frac{93 - 71}{8} = 2.75$$

$$\text{Math: } z = \frac{90 - 65}{10} = 2.50$$

Average: 2.625

Victor:

$$\text{Physics: } z = \frac{87 - 68}{9} = 2.11$$

$$\text{Math: } z = \frac{94 - 70}{9} = 2.67$$

Average: 2.39

Possible arguments for Francine - higher in school performance, better physics score

Possible arguments for Victor - higher entrance exam score, comparable to Francine in school performance

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
Level 3 exceptional understanding	**5** **complete and correct, reflecting exceptional understanding**	- 5 criteria correct

Criteria: *1) 1 mark for work shown indicating an appropriate strategy (e.g., using z-scores)*
2) 1 mark for a reasonable analysis of math scores
3) 1 mark for a reasonable analysis of physics scores
4) & 5) 2 marks for a supported conclusion (i.e., 2 arguments and/or assumptions)

Marker Notes:
- *Other answers are possible.*

Student exemplar 1

Total: 5 marks

The physics department at the Zenith University is considering two students for an entrance scholarship. Both students wrote the same entrance exam. In order to determine who should receive the money, the committee examines the entrance exam scores, as well as the students' performance in their Senior 4 math and physics courses.

Compare the profiles of the following two candidates and decide who you would recommend.

Using the normal distribution, support your recommendation with at least 2 arguments.

Clearly state any assumptions you have made.

Candidates	Entrance Exam (%)	Senior 4 Physics course (%)			Senior 4 Math course (%)		
		student mark	class $\bar{x}$	class σ	student mark	class $\bar{x}$	class σ
Francine	91	93	71	8	90	65	10
Victor	95	87	68	9	94	70	9

I believe Francine has better marks her Exam wasn't as good but has a high average in physics and math

0 mark:

- No use of z-scores or normal distribution

Student exemplar 2

Total: 5 marks

The physics department at the Zenith University is considering two students for an entrance scholarship. Both students wrote the same entrance exam. In order to determine who should receive the money, the committee examines the entrance exam scores, as well as the students' performance in their Senior 4 math and physics courses.

Compare the profiles of the following two candidates and decide who you would recommend.

Using the normal distribution, support your recommendation with at least 2 arguments.

Clearly state any assumptions you have made.

Candidates	Entrance Exam (%)	Senior 4 Physics course (%)			Senior 4 Math course (%)		
		student mark	class $\bar{x}$	class σ	student mark	class $\bar{x}$	class σ
Francine	91	93	71	8	90	65	10
Victor	95	87	68	9	94	70	9

$z = \frac{93-71}{8} = .0275$ $z = \frac{.90-.65}{10} = .025$

$z = \frac{87-68}{9} = .0211$ $z = \frac{.94-.70}{9} = .026$

.006 .001

↑

Greater difference

Francine was better in school

I recommend Francine because she got better in school which is a whole course not one exam.

4 marks:

- 1 mark for strategy
- 2 marks for reasonable analyses of math and physics scores
- 1 mark for conclusion

Student exemplar 3

Total: 5 marks

The physics department at the Zenith University is considering two students for an entrance scholarship. Both students wrote the same entrance exam. In order to determine who should receive the money, the committee examines the entrance exam scores, as well as the students' performance in their Senior 4 math and physics courses.

Compare the profiles of the following two candidates and decide who you would recommend.

Using the normal distribution, support your recommendation with at least 2 arguments.

Clearly state any assumptions you have made.

Candidates	Entrance Exam (%)	Senior 4 Physics course (%)			Senior 4 Math course (%)		
		student mark	class $\bar{x}$	class σ	student mark	class $\bar{x}$	class σ
Francine	91	93	71	8	90	65	10
Victor	95	87	68	9	94	70	9

Math Francine $z = \frac{90-65}{10} = 2.5$

Victor $z = \frac{94-70}{10} = 2.4$

Physics Francine $\frac{93-71}{8} = 2.75$

Victor $\frac{87-68}{9} = 2.11$

From what I can figure out Francine did a little better in high school but did worse on the exam. Victor on the other hand did better on the exam but a little lower in his high school marks. My choice would be Victor because he did better on the entrance examination. We don't know how each of their teachers taught at each of their schools, so that would not be a fair judgement. But when compared on the same test Victor did the best.

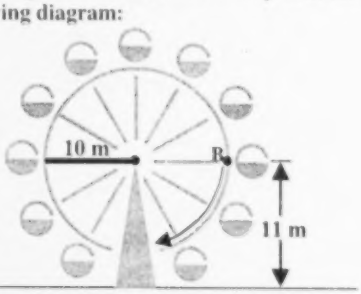
5 marks:

- Complete and correct with a trivial error in Victor's z-score calculation

Question No. 20 and Answer

Total: 3 marks

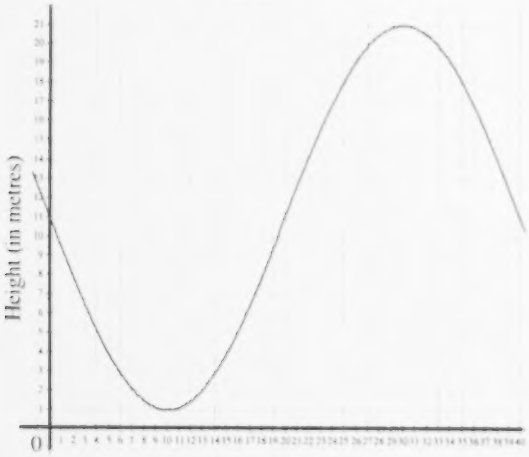
A Ferris wheel has a radius of 10 m and turns clockwise. The distance that a passenger is from the ground varies sinusoidally with time. The Ferris wheel is shown in the following diagram:



When the Ferris wheel is finished being loaded with passengers, Brent is at point B, 11 m off the ground. From point B, it takes Brent 30 seconds to reach the highest point on the wheel.

a) **Sketch the height of B with respect to time for one revolution of the Ferris wheel. Clearly label your graph.**

(2 marks)



b) **State the equation that represents the rotation of the Ferris wheel.**

(1 mark)

Possible equations:

$y = 10\sin\left(\frac{\pi}{20}x + \pi\right) + 11$

$y = 10\sin\left(\frac{\pi}{20}x - \pi\right) + 11$

$y = 10\sin(0.157x + 3.14) + 11$

$y = 10\sin(0.157x - 3.14) + 11$

OR

$y = 10\sin(0.157(x + 20)) + 11$

$y = 10\sin(0.157(x - 20)) + 11$

$y = 10\cos\left(\frac{\pi}{20}(x + 10)\right) + 11$

$y = 10\cos(0.157x + 1.57) + 11$

Where y is the height in metres and x is the time in seconds

Marking Key
1 mark for sketching one correct revolution in a)
1 mark for the correct graph in a) showing maximum and minimum values (i.e., labelling graph)
1 mark for the correct equation in b) or consistent with diagram in a)

Specific Outcomes: G1, G3 **Item Type: Open Response**

Question No. 21 and Answer

Total: 5 marks

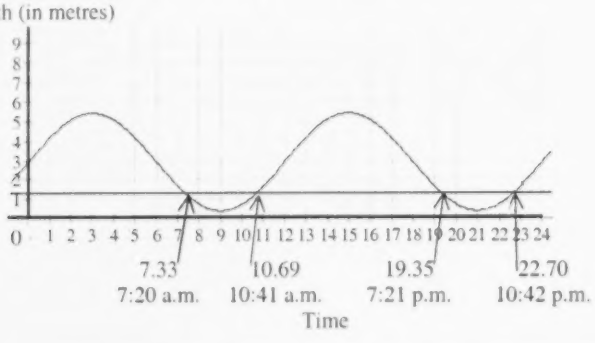
Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres and t represents the number of hours since midnight

a) Create a graph showing the depth of water over 24 hours.

(1 mark)



b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

OR **OR**

$\text{Max}_1 = (3.00; 5.4)$ $\text{Max}_2 = (15.02; 5.4)$ Period = 12.02 hours	$\text{Min}_1 = (9.01; 0.4)$ $\text{Min}_2 = (21.02; 0.4)$ Period = 12.01 hours	$p = \frac{2\pi}{b}$ $= \frac{2\pi}{0.523}$ $= 12$ hours

It represents the time elapsed between the subsequent high or low tides.

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

She cannot travel between 7:20 a.m. and 10:41 a.m. and between 7:21 p.m. and 10:42 p.m.

She can travel between 1:00 a.m. and 6:00 a.m. and between 12 p.m. and 6:15 p.m. and between 10:42 p.m. and 7:20 a.m.

OR

She can travel between 10:41 a.m. and 7:21 p.m. and between 10:42 p.m. and 7:20 a.m.

OR

Her trips can be 6:00 a.m. to 11:00 a.m. and 12:00 p.m. to 5:00 p.m.

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
Level 3 exceptional understanding	**5** **complete and correct, reflecting exceptional understanding**	- 5 criteria correct

Criteria:

1) 1 mark for the correct graph presented in a) (i.e., labelling graph with scales, or labelling a few coordinates, etc.)
2) 1 mark for the correct period in b)
3) 1 mark for the correct explanation given in b)
4) 1 mark for work shown indicating an appropriate strategy in c) (i.e., time conversion)
5) 1 mark for a correct interval in c)

Marker Notes:

- *If students do not convert the time table to hours and minutes, deduct 1 mark (e.g., 7.33 equals 7:20 a.m.)*
- *Accept answers within 15 minutes of the ones presented here - especially if the answers are consistent with their graph.*

Student exemplar 1

Total: 5 marks

Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres
and t represents the number of hours since **midnight**

a) Create a graph showing the depth of water over 24 hours.

(1 mark)

b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

period: $\frac{2\pi}{b}$ $b = 0.523$ $\frac{2\pi}{0.523}$ is the period.

$= 12.01373864$

$= 12.01$

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

1 mark:
- Correct period in b)

Student exemplar 2

Total: 5 marks

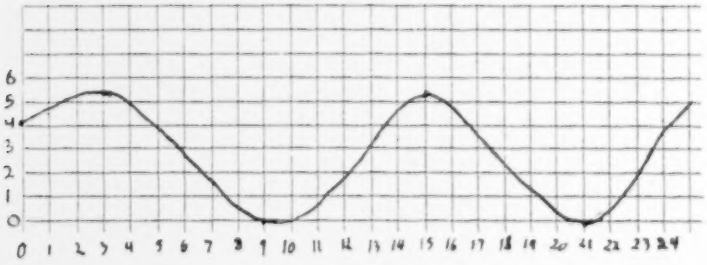
Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres
and t represents the number of hours since **midnight**

a) Create a graph showing the depth of water over 24 hours.

(1 mark)



b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

1st x = 3.043 15.043 - 3.043 = 12 The period of the function is 12.

2nd x = 15.043

This represents the shortest interval at which the graph repeats itself.

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

2 marks:
- 1 mark for graph in a)
- 1 mark for period in b)

Student exemplar 3

Total: 5 marks

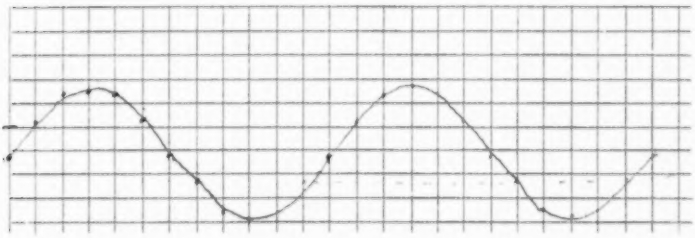
Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres
and t represents the number of hours since **midnight**

a) Create a graph showing the depth of water over 24 hours.

(1 mark)



b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

amount of time for water to be the same level again ; represents 1 full tide.

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

Midnight - 7:00 AM

11:30 AM - 7PM

Between 7:00 AM + 11:30 AM the water is too low for her to safely navigate the channel.

3 marks:

- 1 mark for correct graph in a) despite no depth or time label - points and minimum 1.3 m depth indicated
- 1 mark for correct explanation in b)
- 1 mark for correct interval in c)

Student exemplar 4

Total: 5 marks

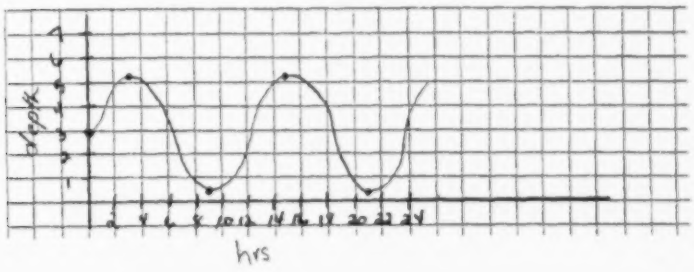
Rachel manages an ocean fishing operation. She passes through a channel where the depth of water (measured in metres) varies with time and can be modelled by the following function:

$$d(t) = 2.5\sin(0.523\,t) + 2.9$$

where $d(t)$ represents the depth of the water in metres
and t represents the number of hours since **midnight**

a) Create a graph showing the depth of water over 24 hours.

(1 mark)



b) What is the period of this function and what does it represent with respect to the varying depth of water?

(2 marks)

Period = 12.01 hr. it represents how long it takes for one tide

c) Rachel's boat requires a depth of at least 1.3 metres of water to safely navigate through the channel. She needs to make two trips a day of at least 5 hours each.

Design a daily timetable showing when Rachel could safely navigate through the channel. Support your answer. Express time in hours and minutes.

(2 marks)

1 am → 6 am

12 pm → 18:00 pm

She can safely navigate through the channel.

5 marks:

- Complete and correct
- Student's answer did not require a time conversion in this case

Question No. 22 and Answer

Total: 4 marks

For a particular infection, an antibiotic medication is given in the form of a 500 mg pill. One pill is taken at 8:00 a.m. each morning. By the next day, at 8:00 a.m., 25% of the antibiotic medication has been released from the body.

a) Calculate the amount of antibiotic medication in the body at 8:00 a.m. each day, for six days.

(2 marks)

Pill 1	500 mg	Day 1
Pill 2	875 mg	Day 2
Pill 3	1156.25 mg	Day 3
Pill 4	1367.19 mg	Day 4
Pill 5	1525.39 mg	Day 5
Pill 6	1644.04 mg	Day 6

$u(n) = u(n-1) * 75 + 500$

b) The same antibiotic medication is also used to fight a different infection. Suggest a way to take only six pills to achieve a level of at least 1000 mg daily in the body for more than five days. Pills can only be taken at 8:00 a.m. Partial pills can be taken. Show work to support your answer.

(2 marks)

○○	Take 2 pills immediately	1000 mg	Day 1
D	Take ½ pill	1000 mg	Day 2
D	Take ½ pill	1000 mg	Day 3
D	Take ½ pill	1000 mg	Day 4
D	Take ½ pill	1000 mg	Day 5
D	Take ½ pill	1000 mg	Day 6
D	Take ½ pill	1000 mg	Day 7
D	Take ½ pill	1000 mg	Day 8 then decreases*

OR

Day 1	500 mg (full pill)
Day 2	875 mg (full pill)
Day 3	1156.25 mg (full pill)
Day 4	1117.19 mg (half pill)
Day 5	1087.89 mg (half pill)
Day 6	1065.92 mg (half pill)
Day 7	1049.4 mg (half pill)
Day 8	1037.1 mg (half pill)
Day 9	1027.8 mg (half pill)
	still above, (run out of pills)

OR

Day 1	1500 mg (3 pills)
Day 2	1500 mg × 0.75 = 1125 + 500 = 1625 mg (full pill)
Day 3	1718.75 mg (full pill)
Day 4	1289.1 mg + 500 mg = 1789.1 mg (full pill)
Day 5	1341.8 mg (no pill)
Day 6	1006.3 mg (no pill)
	3 pills on 1st day, 1 pill each day for next 3 days

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
Level 2 good understanding	**2** **reasonable attempt, appropriate strategy, minor errors and/or omissions**	- 2 criteria correct
	3 **complete and correct with minor errors**	- 3 criteria correct
Level 3 exceptional understanding	**4** **complete and correct, reflecting exceptional understanding**	- 4 criteria correct

Criteria:

1) *1 mark for work shown indicating an appropriate strategy to calculate medication level (in mg) in a)*
2) *1 mark for a correct answer in a)*
3) *1 mark for work shown indicating an appropriate strategy that gets to 1000 mg for longer than 5 days in b)*
4) *1 mark for a correct calculation of milligrams in b) or answer consistent with their strategy*

Marker Notes:

- *In part a), if students use 0.25 instead of 0.75 and include the 500 mg per day, award 1 mark.*
- *In part b), if student achieves 1000 mg for only 5 days and all of the work is correct, award 1 mark.*

Student exemplar 1

Total: 4 marks

For a particular infection, an antibiotic medication is given in the form of a 500 mg pill. One pill is taken at 8:00 a.m. each morning. By the next day, at 8:00 a.m., 25% of the antibiotic medication has been released from the body.

a) Calculate the amount of antibiotic medication in the body at 8:00 a.m. each day, for six days.

(2 marks)

day	amount
1	500.00mg
2	875.00mg
3	781.25mg
4	710.94mg
5	658.20mg
6	618.65mg

b) The same antibiotic medication is also used to fight a different infection. Suggest a way to take only six pills to achieve a level of at least 1000 mg daily in the body for more than five days. Pills can only be taken at 8:00 a.m. Partial pills can be taken. Show work to support your answer.

(2 marks)

Take 2 pills on the first day and one on the next 4 days

1 mark:

- No marks for a)
- 1 mark for appropriate strategy but no work shown in b)

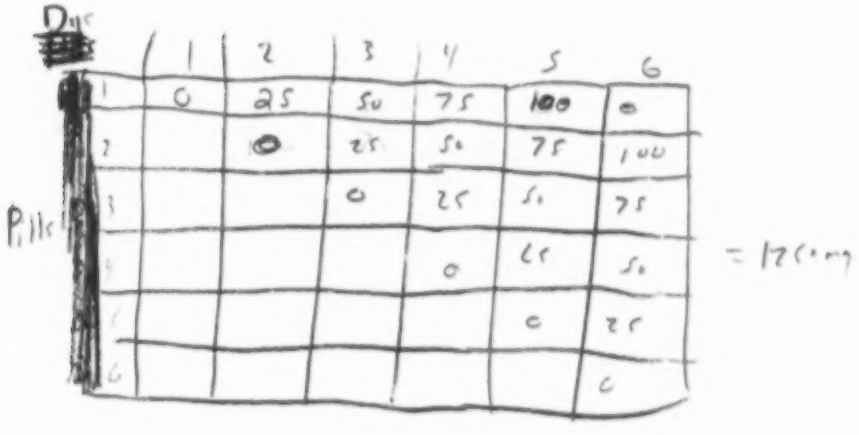
Student exemplar 2

Total: 4 marks

For a particular infection, an antibiotic medication is given in the form of a 500 mg pill. One pill is taken at 8:00 a.m. each morning. By the next day, at 8:00 a.m., 25% of the antibiotic medication has been released from the body.

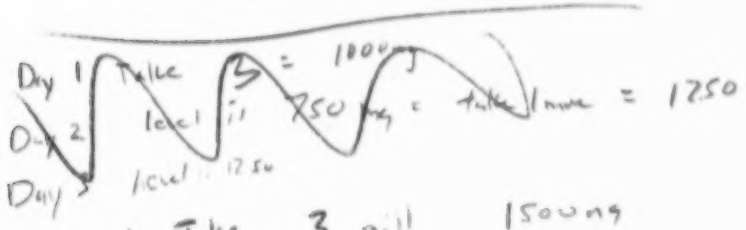
a) Calculate the amount of antibiotic medication in the body at 8:00 a.m. each day, for six days.

(2 marks)



b) The same antibiotic medication is also used to fight a different infection. Suggest a way to take only six pills to achieve a level of at least 1000 mg daily in the body for more than five days. Pills can only be taken at 8:00 a.m. Partial pills can be taken. Show work to support your answer.

(2 marks)



Day 1 Take 3 pill 1500 mg
Day 2 = 1125 mg + 500 (1 more) 1625 mg
Day 3 = 1218.75 mg don't take any
Day 4 = Take 1 more = 1281 mg in body
Day 5 Take 1 more = 1781.0625
Day 6 = No more pills but 1341.796 mg in body
Day 7: 1006.3476 mg still in body.

2 marks:
- No marks for a)
- 2 marks for b) despite trivial calculation errors

Student exemplar 3

Total: 4 marks

For a particular infection, an antibiotic medication is given in the form of a 500 mg pill. One pill is taken at 8:00 a.m. each morning. By the next day, at 8:00 a.m., 25% of the antibiotic medication has been released from the body.

a) Calculate the amount of antibiotic medication in the body at 8:00 a.m. each day, for six days.

(2 marks)

Day -	1	2	3	4	5	6
mg -	500	875	1156.25	1367.19	1525.4	1644.04

500 × 0.25 = 125

500 − 125 = 375

375 + 500 = 875.

I did the same calculation for the rest of the chart.

b) The same antibiotic medication is also used to fight a different infection. Suggest a way to take only six pills to achieve a level of at least 1000 mg daily in the body for more than five days. Pills can only be taken at 8:00 a.m. Partial pills can be taken. Show work to support your answer.

(2 marks)

Take 2 pills the first day

Day 1 1000 mg − 250 − 2 pills on one day

2 750 − 500 = 1250 − 1 pill

3 → 1437.5 − 1 pill

4 1578.12 − 1 pill

5 1683.59 − 1 pill

6 1262.7 − no more pills but we still have more than 1000 mg in the body.

4 marks:
- All complete and correct

Specific Outcomes: H1 **Item Type: Restricted Response with Explanation**

Question No. 23 and Answer

In October, an oil well in Alberta produced 80 m^3 of oil. Each month, the well produces 3.1% less oil than the previous month.

Total: 3 marks

a) **In total, how much oil will be produced during a 6-month period beginning October 1st? Show how you arrived at your answer.**

(2 marks)

Month	m^3
October	80.00
November	77.52
December	75.12
January	72.79
February	70.53
March	68.35

OR

Seq. Mode
nMin = 1
u (n) = u (n – 1) * 0.969
u (nMin) = {80}
Month 6: 68.35

Total of 444.31 m^3 of oil

b) **Once the well production drops below 60 m^3 per month, it is not profitable to operate the well. In which month will it no longer be profitable to operate the well?**

(1 mark)

Month	m^3
March	68.35
April	66.23
May	64.18
June	62.19
July	60.26
August	58.39

In August, the well should be closed

Marking Key
1 mark for work shown indicating an appropriate strategy
1 mark for the correct answer in a)
1 mark for the correct answer in b) or consistent with a)

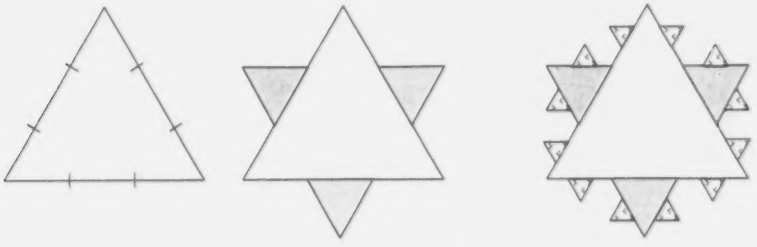
Specific Outcomes: H2, H3 **Item Type: Restricted Response**

Question No. 24 and Answer

Total: 3 marks

The equilateral triangle of Generation 1 measures 27 centimetres on each side. Each side has been divided into 3 equal segments. An equilateral triangle is placed on the middle segment as shown in the three generations below.

Generation 1 **Generation 2** **Generation 3**



Complete the chart below to show the perimeters of each of these generations and of the 4th generation.

Generation	Number of sides	Length of sides	Perimeters
1	**3**	**27 cm**	**81 cm**
2	12	9 cm	108 cm
3	48	3 cm	144 cm
4	192	1 cm	192 cm

Marking Key
1 mark for the correct pattern for number of sides *1 mark for the correct lengths of sides* *1 mark for the correct perimeters provided* *or* *1 mark for each correct generation*

Marking Keys and Scoring Rubrics for the Inquiry Task

Inquiry Task Question No. 1 and Answer

DESIGN AND MEASUREMENT

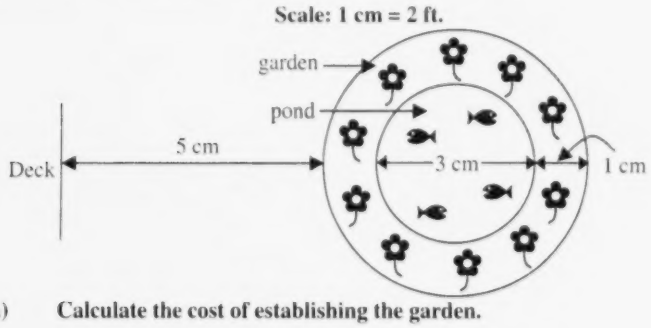
Total: 10 marks

Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

In order to create this garden, they must:

1) **excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.**
2) **line the pond basin with a pond liner.**
3) **add a 2 inch layer of topsoil for the flower bed.**

Supplies/services: (MUST BE PURCHASED IN WHOLE UNITS)
Excavation: $1.49 per cubic foot plus GST only
Soil: $1.99 per 1ft.^{3} bag plus PST and GST
Pond liner: $75.00 plus PST and GST



a) Calculate the cost of establishing the garden.

(6 marks)

Flower Garden	Pond
$\pi(5)^2 - \pi(3)^2 = 50.27$ ft.^{2}	Excavation $V = \pi(3)^2(3)$
$\times$ 2/12	$= 84.82$ ft.^{3}
8.38 ft.^{3}	85 ft.^{3} $\times$ \$1.49 = \$126.65
9 bags $\times$ \$1.99 = \$17.91	$\times$ 1.07
$\times$ 1.14	= \$135.52
\$20.42	Pond liner
	\$75.00 $\times$ 1.14 = \$85.50

Total cost of flower garden and pond: \$241.44

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" $\times$ 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)

OR

Paving stone = 6 in.^{2}
Reasonable dimensions for walkway
(ex. 10 ft. $\times$ 2.5 ft. = 25 ft.^{2})
Feet $\rightarrow$ inches conversion: $25 \times 144 = 3600$ in.^{2}
$3600 \div 6 = 600$ stones
$600 \times \$0.47 = \$282.00 \times 1.14 = \$321.48$

OR

Surface area: 120 in. $\times$ 36 in. = 4320 in.^{2}
1 paving stone = 6 in.^{2}
$\frac{4320}{6} = 720$ paving stones needed
$720 \times \$0.47 = \$338.40$
Total cost $\$338.40 \times 1.14 = \$385.78$

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- any combination of criteria for 1 mark
	2 **reasonable attempt, inappropriate strategy, major errors or omissions**	- any combination of criteria for 2 marks
	3 **reasonable attempt, inappropriate strategy but carried through correctly**	- any combination of criteria for 3 marks
Level 2 good understanding	**4** **sound strategy with major errors**	- any combination of criteria for 4 marks
	5 **sound strategy with minor errors**	- any combination of criteria for 5 marks
	6 **mostly complete with some omissions**	- any combination of criteria for 6 marks
	7 **close to complete and correct, major errors**	- any combination of criteria for 7 marks
Level 3 exceptional understanding	**8** **close to complete and correct, minor errors**	- any combination of criteria for 8 marks
	9 **almost complete and correct, trivial errors**	- any combination of criteria for 9 marks
	10 **complete and correct, reflecting exceptional understanding**	- any combination of criteria for 10 marks

Criteria:

Part a):

1) *1 mark for correct calculation of surface area of garden*
2) *1 mark for correct calculation of top soil volume*
3) *1 mark for correct calculation of costs for top soil (consistent with their volume)*
4) *1 mark for correct calculation of excavation volume*
5) *1 mark for correct calculation of excavation costs (consistent with their volume)*
6) *1 mark for correct calculation of total costs (including GST and PST) (consistent with above calculations)*

*Part b):**

7) *1 mark for a reasonable design of walkway including dimensions*
8) *1 mark for correct calculation of walkway surface area*
9) *1 mark for correct calculation of the number of paving stones required*
10) *1 mark for the correct calculation of the cost of walkway that is between $300.00 and $400.00 or consistent with their calculation of walkway surface area (must include PST and GST or no marks are to be awarded)*

Marker Notes:

- *Other answers possible for b).*
- ** Other strategies possible for b).*
- *For supplies and services which must be purchased in whole units, if student does not restrict to whole units or rounds incorrectly to whole units, deduct 1 mark only once.*
- *Award marks for criterion 8 if correct number of paving stones are calculated.*
- *Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide)*

Student exemplar 1

Total: 10 marks

Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

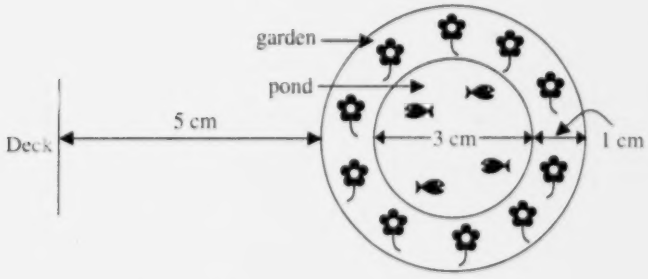
In order to create this garden, they must:

1) excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.
2) line the pond basin with a pond liner.
3) add a 2 inch layer of topsoil for the flower bed.

Supplies/services: (**must be purchased in whole units**)

Excavation:	$1.49 per cubic foot plus GST only
Soil:	$1.99 per $1ft.^3$ bag plus PST and GST
Pond liner:	$75.00 plus PST and GST

Scale: 1 cm = 2 ft.



a) Calculate the cost of establishing the garden.

(6 marks)

Flower Garden	Pond
Excavation - 2feet@1.49+GST $2.98 .21 $3.19	Pond Liner - $75 + TAX $5.25 $5.25 $85.50
Soil - 2 feet @1.99 + TAX 3.98 .28 .28 $4.54	Excavation - 6 feet + 3 feet @$1.49+GST $10.47 .73¢ $11.20

Total cost of flower garden and pond: $11.20 + $85.50 + $3.19 + $4.54 = $104.43

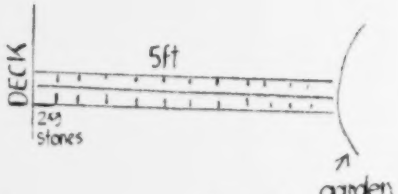
Student exemplar 1 continued

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" × 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)

1cm: 2ft



Stones
850 stones @ 47¢ + TAX
399.50
27.97
27.97
$455.43

Excavation
10 feet @ $1.49 + GST
14.90
1.04
$15.94

Total: 455.43 + 15.94 = $471.37

2 marks:
- 1 mark for total cost of garden in a)
- 1 mark for a reasonable design of walkway area in b)

Student exemplar 2

Total: 10 marks

Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

In order to create this garden, they must:

1) excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.
2) line the pond basin with a pond liner.
3) add a 2 inch layer of topsoil for the flower bed.

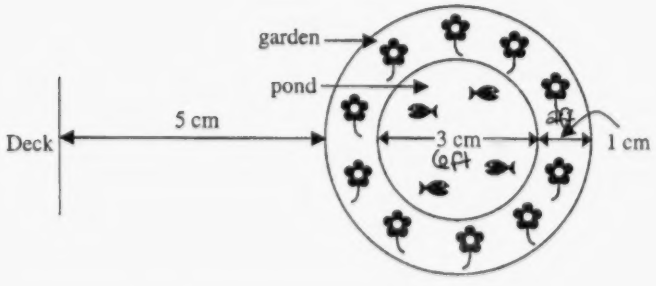
Supplies/services: (**must be purchased in whole units**)

Excavation:	\$1.49 per cubic foot plus GST only
Soil:	\$1.99 per $1ft.^3$ bag plus PST and GST
Pond liner:	\$75.00 plus PST and GST

$A = \pi r^2$
$A = \pi 6^2$
$A = \pi 36$
$A = 113.10 ft^2$

$C = 2\pi r$
$= 2\pi 6$
$= 37.70 ft$

Scale: 1 cm = 2 ft.



a) Calculate the cost of establishing the garden.

(6 marks)

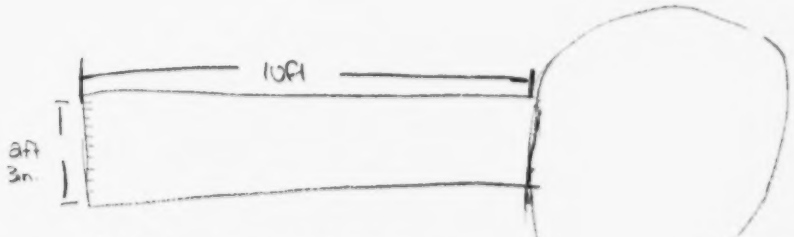
Flower Garden	Pond
$C = 2\pi r$ $C = 60.83 ft^2$ $60.83 \times 12 inc = 753.98 inc$ $\times 2 = 1507.96 inc^3$ $\div 12$ $= 125.66 ft^3$ $1.99 \times 125.66 = 250.06$ GST + PST = 285.07	$C = 2\pi r$ $V = 113.10 ft^3$ $= 37.70 ft^2$ Cost = 1.49 x $113.10 ft^3$ = 168.52 with GST = 180.32 Total for liner - 85.50 Total = 265.82

Total cost of flower garden and pond: 550.89

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" × 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)



$\frac{60}{3} = 60$ rows # of paving stones = 600 stones

$\times 10 = 600$ stones cost for stones: $282.00

$\times 1.14 = \$321.48$

6 marks:

Part a)

- 1 mark for the correct calculation of top soil costs (criterion 2 not awarded due to a conversion error which is a minor error - see page 2)
- 1 mark for correct calculation of excavation costs consistent with their error
- 1 mark for total costs consistent with their error(s)

Part b)

- All correct except for the number of paving stones required which is incorrect

Student exemplar 3

Total: 10 marks

Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

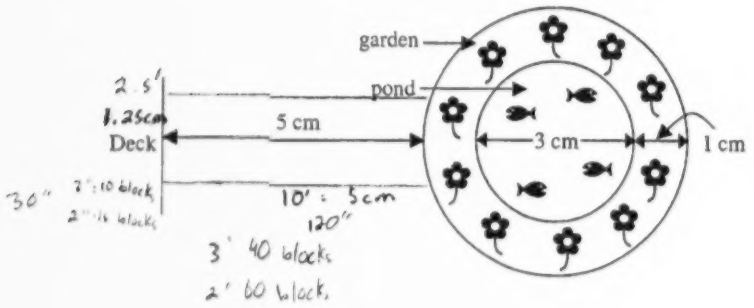
In order to create this garden, they must:

1) excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.
2) line the pond basin with a pond liner.
3) add a 2 inch layer of topsoil for the flower bed.

Supplies/services: **(must be purchased in whole units)**

Excavation:	$1.49 per cubic foot plus GST only
Soil:	$1.99 per 1ft.^{3} bag plus PST and GST
Pond liner:	$75.00 plus PST and GST

Scale: 1 cm = 2 ft.



a) Calculate the cost of establishing the garden.

(6 marks)

Flower Garden

Pond radius garden
$A = \pi r^2$ A = 12.57
$= \pi 2^2$ − 7.07
$= 12.57 cm^2$ 5.5cm^2

Total soil = 5.5
× 2
11cm^3

11 bags of soil
$1.99
× 11
21.89
7% 1.53
7% 1.53
$24.95

Pond

$A = \pi r^2$
$\pi 1.5^2$
$= 7.07 cm^2$

Excavation: 7 × 3 × 3 = 27cm^3
$1.49
× 27
40.23
+ 2.82
$43.05

Liner: 75.00
7% 5.25
7% 5.25
$85.50

Total = 43.05
+ 85.50
$128.55

Total cost of flower garden and pond: 24.95 + 128.55 = $153.50

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" × 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)

2.5×10 walkway

2.5'×12" = 30"

10'×12" = 120"

30" = 10 blocks wide

120" = 60 blocks length

numbers of blocks needed

60×10 = 600 blocks

600 × 47¢ = 282

7% 19.74

7% 19.74

$321.48

7 marks:

Part a)

- 1 mark for correct calculation of costs for top soil consistent with volume
- 1 mark for correct calculation of excavation costs consistent with volume
- 1 mark for correct calculation of total costs including taxes consistent with earlier calculations

Part b)

- All criteria satisfied

Student exemplar 4

Total: 10 marks

Karina and Herbert just moved into a new house. They want to create a circular flower garden in the middle of their yard. In the centre of their garden they plan to dig a pond in which they will keep fish and water plants. The dimensions of each part can be determined from the scale diagram below.

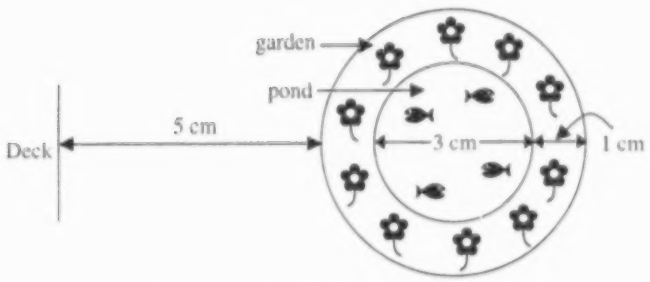
In order to create this garden, they must:

1) excavate (dig) the pond to a uniform depth of 3 feet with a flat bottom.
2) line the pond basin with a pond liner.
3) add a 2 inch layer of topsoil for the flower bed.

Supplies/services: (**must be purchased in whole units**)

Excavation: $1.49 per cubic foot plus GST only
Soil: $1.99 per 1ft.^{3} bag plus PST and GST
Pond liner: $75.00 plus PST and GST

Scale: 1 cm = 2 ft.



a) Calculate the cost of establishing the garden.

(6 marks)

Flower Garden

total Area
$A = \pi r^2$
$A = \pi(5)^2$
$A = 78.54 ft^2$

garden area
total area − pond area
$= 78.54 - 28.27$
$= 50.27 ft^2$

Volume soil
$V = 50.27 ft^2 \times .17 ft$
$V = 8.55 ft^3$
round to $9 ft^3$

cost of soil
$\$1.99 \times 9 ft^3 =$
$= \$17.91$

Tax
$\$17.91 \times .07 \times .07$
$= \$2.51$

Total cost
$\$17.91 + \$2.51$
$= \$20.42$

Pond

area
$A = \pi r^2$
$A = \pi(3)^2$
$A = 28.27 ft^2$

volume
$V = 28.27 ft^2 \times 3 ft$
$V = 84.81 ft^3$

Excavation cost
$84.81 ft^3 \times \$1.49$
$= \$126.37$

Tax
$\$126.37 \times .07$
$= \$8.85$

liner tax
$\$75.00 \times .07 \times .07$
$= \$10.50$

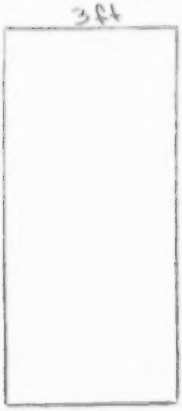
Total cost
$\$126.37 + \$8.85 + \$75.00 + \$10.50$
$= \$220.72$

Total cost of flower garden and pond: $\$20.42 + \$220.72 = \$241.14$

b) The following year, Karina and Herbert would also like to design a 10 ft. walkway from their deck to the edge of the pond. The walkway will be covered by 2" × 3" paving stones that cost 47¢ each plus PST and GST. Assume they will do any necessary excavation to lay the paving stones.

Design and sketch a walkway (include its dimensions) so that its total cost including taxes is between $300.00 and $400.00.

(4 marks)



Walkway Area

$A = lw$

$A = 36" \times 120" = 4320"^2$

Bricks

$2" \times 3"$

$= 6"^2$

Number of bricks

$4320"^2 \div 6"^2$

$= 720$ bricks

Cost

$720 \times \$.47$

$= \$338.40$

Total Cost

$\$338.40 + \$47.38$

$= \$385.78$

TAX

$338.40 \times .07 \times .07$

$= \$47.38$

10 marks:

- All complete and correct
- In a), forgetting to round the volume up to the nearest whole unit is a trivial error - no deduction

Specific Outcomes: C2, C4 Item Type: Restricted Response with Explanation

Inquiry Task Question No. 2 and Answer

PERSONAL FINANCE

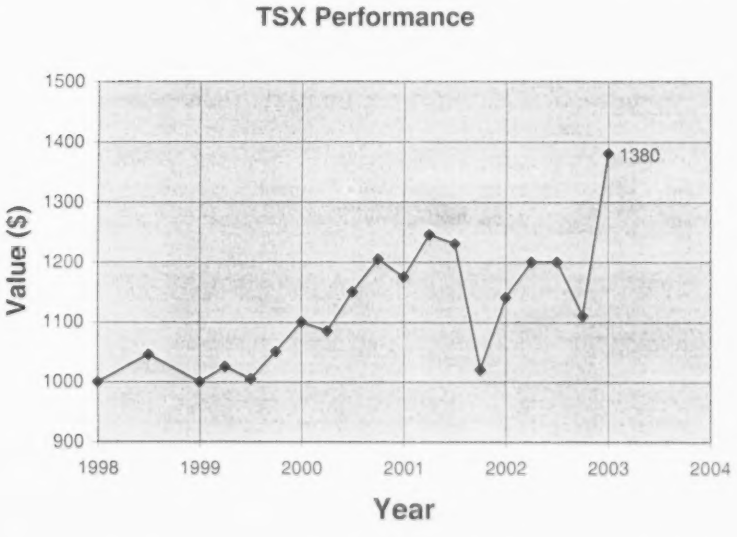
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

$\$75\,000 \times 1.05 =$ $\$78\,750$ → 1999
$\$82\,687.50$ → 2000
$\$86\,821.88$ → 2001
$\$91\,162.97$ → 2002
$\$95\,721.12$ → 2003

OR

N = 5
I% = 5
PV = –75 000
PMT = 0
FV = 95 721.12
P/Y = 1
C/Y = 1
PMT = END

realtor fees $\$95\,721.12 \times 0.06 = \$5743.27$
house repairs $\$95\,721.12 - \$7000.00 = \$88\,721.12$
balance $\$88\,721.12 - \$5743.27 = \$82\,977.85$

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

$\$1000 \rightarrow \$1380$
$\$75\,000 \rightarrow \$103\,500$

$\$103\,500 \times 1.5\% = \$1552.50$
$\$103\,500 - \$1552.50 = \$101\,947.50$
$\$101\,947.50 - \$75\,000 = \$26\,947.50$

$\$26\,947.50 \times 0.29 = \$7814.78$ (taxes)
$\$26\,947.50 - \$7814.78 = \$19\,132.72$
$\$19\,132.72 + \$75\,000 = \$94\,132.72$

OR

$\$1000 \rightarrow \$1380$
$\$75\,000 \rightarrow \$103\,500$

$\$103\,500 \times 1.5\% = \$1552.50$
$\$103\,500 - \$75\,000 = \$28\,500$
$\$28\,500 \times 0.29 = \$8265$ (taxes)

$\$103\,500 - \$1552.50 - \$8265 = \$93\,682.50$

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

Mort and Sally should cash in the investment because it is worth more than selling the house.

OR

They should keep the investment because it has the potential to earn money faster.

Marker Notes:

- *If a student attempts to show a house value based on 5 years but is incorrect, award 1 out of 2 marks*

Marking Key	
Part a):	*1 mark for work shown indicating an appropriate strategy in finding value of house* *1 mark for correct value of house in 2003* *1 mark for correct calculation of realtor fees* *1 mark for subtracting house repairs* *1 mark for correct net value of house consistent with above calculations*
Part b):	*1 mark for value of $103 500 in 2003* *1 mark for management fees* *1 mark for correct calculation of income tax* *1 mark for net value of investment consistent with above calculations*
Part c):	*1 mark for justification of their recommendation in c) consistent with their work*

Student exemplar 1

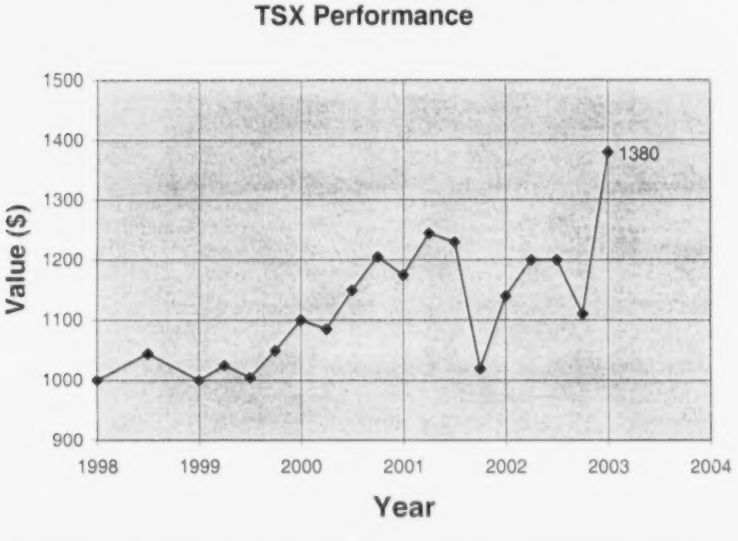
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

Question 1a)

Year	Price of House	
1998	$75,000.00	
1999	$71,250.00	
2000	$67,687.50	
2001	$64,303.13	
2002	$61,087.97	
2003	$58,033.57	$65,033.57

$3,482.01

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

Question 1b)

Year	Investment
1998	$75,000.00
1999	
2000	
2001	
2002	
2003	

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

I need to understand this question, but could not get it.

1 mark:

- 1 mark for appropriate strategy in a)

Student exemplar 2

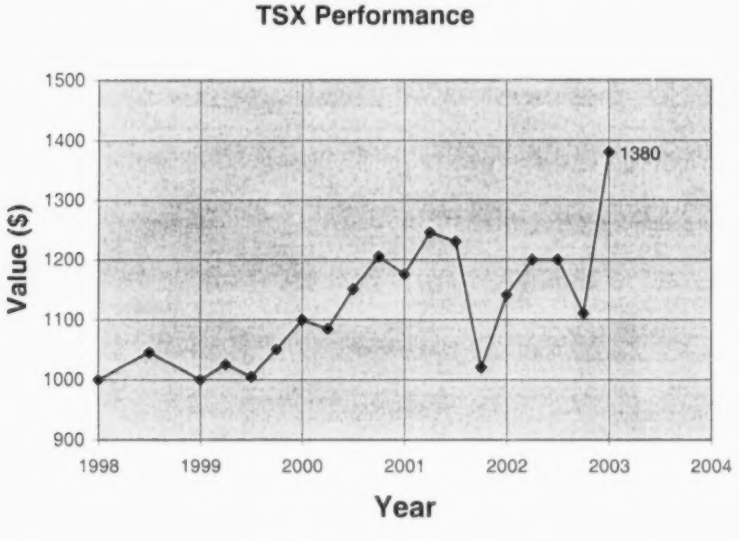
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

Student exemplar 2 continued

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

after 5 years house is worth $104,655.10

realtors fees $6279.31

total amount he would receive for his house = $98 375.79

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

Management fee = 103,500 × .15 = $15,525

75 000 + 38% = $103,500.00

taxes = $28,500 × .29 = $8265

$103,500 − $75 000 = $28,500

15,525
+ 8,265
$ 23,790

103,500 − 23,790 = $79,710

total cash received

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

If they need more money they should plan to sell Mort's house, because he receives more money.

5 marks:

Part a)
- 1 mark for realtor fees consistent with calculation
- 1 mark for net value of house

Part b)
- 1 mark for correct value of investment ($103 500)
- 1 mark for income tax

Part c)
- 1 mark for recommendation

Student exemplar 3

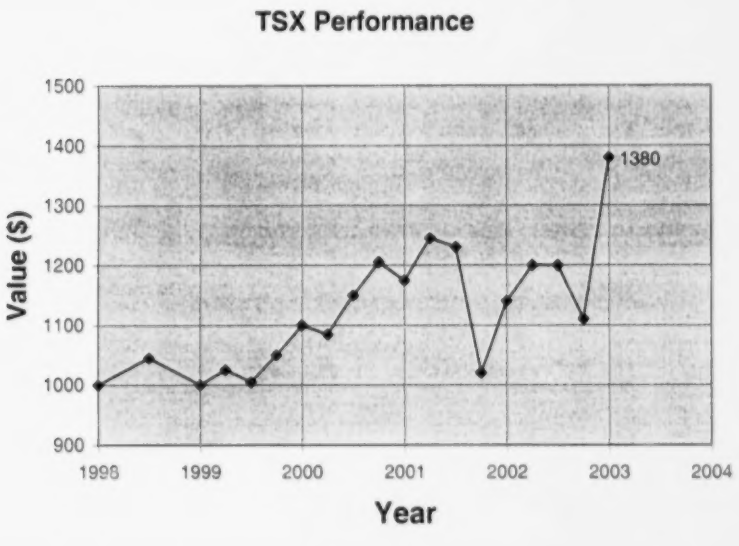
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

$75\,000. \times 0.05 = 3750$ 7000 Repairs

$75\,000 - 3750 = 71250 + 7000$ 78250×0.06

$78\,250 - 4695 = 73555$ 5145

[illegible] $80,605.00

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

$75 \times 1380 = 103500 \times 0.015$ $1552.5 = 101947.5$

$75\,000 - 103500 = 28500 \times 0.29 = 8265.$

$101947.5 - 8265$

$93682.50

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

The should sell the stocks because they would get more money cuz the price has probly peaked. It is also alot harder to sell a house than It is to sell stocks.

6 marks:
- 1 mark for realtor fees
- 4 marks for correct answer in b)
- 1 mark for c)

Student exemplar 4

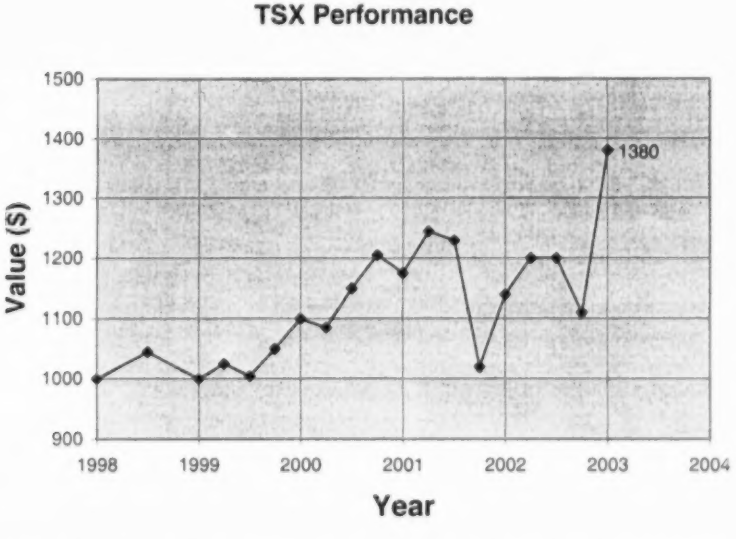
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

Appreciation - 75000 * 0.05 = 3750
3750 * 5 = 18750
Repairs - 7000
Realtors Fees - 75000 + 18750 + 7000 = 100750
100750 * 0.06 = 6045

Mort would recieve $94,705 if he sold his house on January, 1st 2003.

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

1380 * 75 = 103500 → how much her $75,000 is worth now

Management Fee - 103500 * 0.015 = 1552.5

Income Tax Payment - 103500 - 75000 = 28500
28500 * 0.29 = 8265

Sally would recieve $93,682.50 is she sold her investment on Januory 1st, 2003.

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

Id reccomend to the couple to sell the investment so that they could live in the house when they get back.

6 marks:

Part a)
- 1 mark for appropriate strategy
- 1 mark for net value of house based on calculations

Part b)
- All complete and correct

Part c) is incomplete - 0 marks

Student exemplar 5

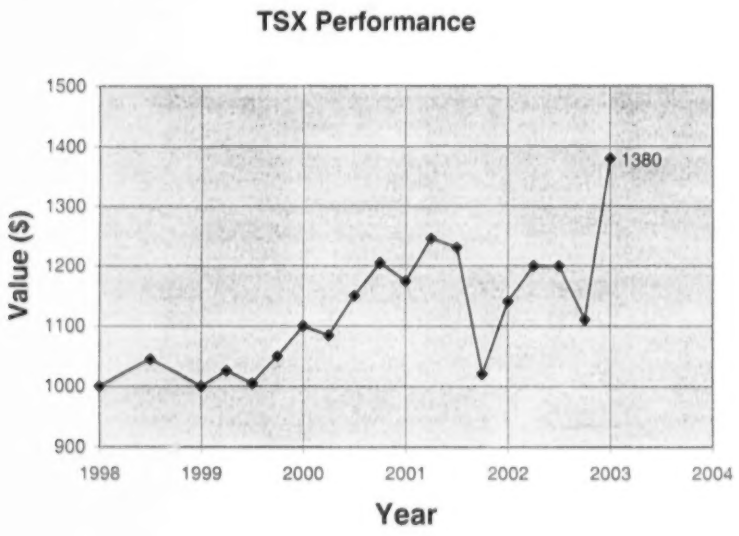
Total: 10 marks

In 1997, Mort and Sally met at a high school class reunion after not seeing each other for many years. Through discussing their respective situations, they learned that they had each recently inherited $75 000.

Mort used his $75 000 to purchase a house on January 1st 1998. According to Statistics Canada, the average residential house price appreciated 5% per year, from January 1, 1998 until January 1, 2003.

Mort has lived in the house until now. If he sells his house, he can expect to pay 6% of the sale price in realtor's fees. He estimates that he has spent $7000 in maintenance over the years.

Sally purchased $75 000 in an investment whose value is directly linked to the performance of the Toronto Stock Exchange. The value of $1000 invested in the TSX from January 1, 1998 until January 1, 2003 is represented by the graph below.



Sally pays a management fee of 1.5% on the value of her investment at the time she cashes it in. In addition, if Sally were to sell her investment, she would be required to pay income tax on the difference between the buying price and the selling price at her marginal tax rate of 29%.

Mort and Sally met again at another class reunion in 2003 and they have decided to get married. They would like to celebrate by going on an extended vacation, and plan to sell either the house or the investment to finance it.

a) Calculate the amount of money Mort would receive if he sold his house on January 1, 2003. In your calculation, include appreciation, repairs and realtor's fees.

(5 marks)

Appreciated Value = $P(1+i)^n$
$= 75000(1.05)^5$
$= \$95721.18$

Repairs - $95721.18 - 7000$
$= 88721.18$

Realtor's Fee's -
$88721.18 - 6\%$
$= \$83397.91$

Mort could receive $83397.91 for selling his house.

b) Calculate the total amount of money Sally would receive if she sold her investment on January 1, 2003. In your calculation, include her management fees and her taxes.

(4 marks)

*TSX rose 38%

Sally's Investment → $75,000 \times 1.38$
$= 103,500$

Management Fee
$103,500 - 1.5\%$
$= 1552.50$

Income Tax
$103,500 - 75,000$
$= 28500 \times .29$
$= 8265.00$

$103,500 - 1552.50 - 8265.00$

$= \$93682.50$

Sally's investment is now worth $93682.50

c) Mort and Sally have two options: to sell the house or the investment. Use the data you generated in a) and b) to justify a recommendation to the couple as to what they should do.

(1 mark)

There are many factors contributing to the decision of what to sell. The stock market may still be rising and could make them more money. The stock market could also drop causing them to lose money. Mort's house could also become damaged causing the value to drop. Mort's house appreciation could also rise creating more money.

9 marks:
- All complete and correct in a) and b)
- Part c) is incomplete - 0 marks

Appendices

APPENDIX A

Table of Specific Outcome Match and Item Type

Multiple-choice items				
Question #	Key	Unit	Specific Outcome	Mark
1	A	A	2	1
2	D	A	1	1
3	D	B	1	1
4	C	D	4	1
5	A	D	3, 5	1
6	B	E	2	1
7	D	E	1	1
8	B	G	1	1
9	C	G	1	1
10	B	H	3	1

Restricted-response items			
Question #	Unit	Specific Outcome	Mark
11	A	1, 2	2
13	B	1	2
15	D	2	2
16	D	2	3
20	G	1, 2	3
24	H	2, 3	3

Restricted-response with explanation items			
Question #	Unit	Specific Outcome	Mark
17	D	3, 4	4
23	H	1	3
Inquiry 1a)	F	1, 2, 3	6
Inquiry 2	C	2, 4	10

Open-response items			
Question #	Unit	Specific Outcome	Mark
12	A	1, 2	5
14	B	2, 3	6
18	E	2, 3	4
19	E	1–3	5
21	G	1, 3	5
22	H	1	4
Inquiry 1b)	F	1, 2, 3	4

APPENDIX B

Generating Student Profiles

Profile of Test Score by Question Type

Item Type	Test Items	Total	÷ Maximum	× 100	= %
Multiple-choice	1 to 10: ____		10		
Restricted-response	11 ____, 13 ____, 15 ____, 16 ____, 20 ____, 24 ____		15		
Restricted-response with explanation	17 ____, 23 ____, Inquiry 1 part a) ____, Inquiry 2 ____		23		
Open-response	12 ____, 14 ____, 18 ____, 19 ____, 21 ____, 22 ____, Inquiry 1 part b) ____		33		

Profile of Test Score by Curriculum Unit

Unit	Test Items	Total	÷ Maximum	× 100	= %
Matrices	1 ____, 2 ____, 11 ____, 12 ____		9		
Vectors	3 ____, 13 ____, 14 ____		9		
Personal Finance	Inquiry 2 ____		10		
Probability	4 ____, 5 ____, 15 ____, 16 ____, 17 ____		11		
Variability and Statistics	6 ____, 7 ____, 18 ____, 19 ____		11		
Design and Measurement	Inquiry 1 ____		10		
Periodic Functions	8 ____, 9 ____, 20 ____, 21 ____		10		
Sequences	10 ____, 22 ____, 23 ____, 24 ____		11		

APPENDIX C—Sheets for marking the Inquiry Tasks

Inquiry Task 1: Design and Measurement	**Booklet Numbers**							
Part a)								
• 1 mark for correct calculation of surface area of garden								
• 1 mark for correct calculation of top soil volume								
• 1 mark for correct calculation of costs for top soil (consistent with their volume)								
• 1 mark for correct calculation of excavation volume								
• 1 mark for correct calculation of excavation costs (consistent with their volume)								
• 1 mark for correct calculation of total costs (including GST and PST) (consistent with above calculations)								
Part b)								
• 1 mark for a reasonable design of walkway including dimensions								
• 1 mark for correct calculation of walkway surface area								
• 1 mark for correct calculation of the number of paving stones required								
• 1 mark for the correct calculation of the cost of walkway that is between $300 and $400 or consistent with their calculation of walkway surface area (must include PST and GST or no marks are to be awarded)								
Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide) **Totals**								

Inquiry Task 1: Design and Measurement	**Booklet Numbers**							
Part a)								
• 1 mark for correct calculation of surface area of garden								
• 1 mark for correct calculation of top soil volume								
• 1 mark for correct calculation of costs for top soil (consistent with their volume)								
• 1 mark for correct calculation of excavation volume								
• 1 mark for correct calculation of excavation costs (consistent with their volume)								
• 1 mark for correct calculation of total costs (including GST and PST) (consistent with above calculations)								
Part b)								
• 1 mark for a reasonable design of walkway including dimensions								
• 1 mark for correct calculation of walkway surface area								
• 1 mark for correct calculation of the number of paving stones required								
• 1 mark for the correct calculation of the cost of walkway that is between $300 and $400 or consistent with their calculation of walkway surface area (must include PST and GST or no marks are to be awarded)								
Maximum ½ mark deduction for each kind of technical communication error (see page 2 of this guide) **Totals**								

Use check marks (✓) to tally students' marks on the question

Inquiry Task 2: Personal Finance	Booklet Numbers									
Part a) • 1 mark for work shown indicating an appropriate strategy in finding value of house										
• 1 mark for correct value of house in 2003										
• 1 mark for correct calculation of realtor fees										
• 1 mark for subtracting house repairs										
• 1 mark for correct net value of house consistent with above calculations										
Part b) • 1 mark for value of $103 500 in 2003										
• 1 mark for management fees										
• 1 mark for correct calculation of income tax										
• 1 mark for net value of investment consistent with above calculations										
Part c) • 1 mark for justification of their recommendation consistent with their work										
Totals										

Inquiry Task 2: Personal Finance	Booklet Numbers									
Part a) • 1 mark for work shown indicating an appropriate strategy in finding value of house										
• 1 mark for correct value of house in 2003										
• 1 mark for correct calculation of realtor fees										
• 1 mark for subtracting house repairs										
• 1 mark for correct net value of house consistent with above calculations										
Part b) • 1 mark for value of $103 500 in 2003										
• 1 mark for management fees										
• 1 mark for correct calculation of income tax										
• 1 mark for net value of investment consistent with above calculations										
Part c) • 1 mark for justification of their recommendation consistent with their work										

Use check marks (✓) to tally students' marks on the question